

C 57. 109 : E 2 / 2

GLOBAL MARKET SURVEY

ELECTRONIC COMPONENTS



U.S. DEPARTMENT OF COMMERCE / Domestic and International Business Administration

This Global Market Survey is one in a series of Bureau of International Commerce publications focusing on overseas marketing opportunities for U.S. suppliers in selected industries. These Surveys are prepared by the Bureau's Office of International Marketing and are based on research conducted in key foreign markets.

GLOBAL MARKET SURVEY

ELECTRONIC COMPONENTS



U. S. DEPARTMENT OF COMMERCE
Frederick B. Dent, Secretary

Domestic and International Business Administration
Tilton H. Dobbin, Assistant Secretary

Bureau of International Commerce
Charles W. Hostler Sr.
Deputy Assistant Secretary and Director

OCTOBER 1974

For sale by the Superintendent of Documents,
U.S. Government Printing Office,
Washington, D.C. 20402.
Price \$2.30

PREFACE

Detailed, on-the-spot studies conducted for the U.S. Department of Commerce in major foreign markets on selected groups of electronic components have recently been completed. The findings are presented in condensed form in this Global Market Survey. They reveal significant growth in demand for electronic components during recent years and indicate a continuation of this trend through the 1970's.

This Survey is intended to serve as an export sales planning tool for marketing decision-makers of American companies engaged in the manufacture of electronic components. It is a ready desk reference of facts and figures on the country markets researched. It identifies the best U.S. export sales opportunities in each market on a product-by-product basis.

International trade specialists at the Department of Commerce in Washington or at the Department's 43 district offices are prepared to work with each firm in the development of an international marketing plan tailored to its own business needs and export capabilities. This is an important phase of a continuing Commerce Department export expansion program. It is designed to help American manufacturers enter overseas markets or to help them increase their export sales. U.S. manufacturers are urged to take advantage of the Department's numerous programs and services aimed at helping them capitalize on the exceptional export growth potentials described in this Survey.

U.S. products and industries featured in Global Market Surveys are selected because of their technological or other competitive advantages in the world marketplace. Global Market Surveys published in 1973 or scheduled for publication in the current year include:

- Agricultural Machinery and Equipment (1973)
- Micrographics Equipment and Supplies (1973)
- Biomedical Equipment (1973)
- Computers and Related Equipment (1973)
- Materials Handling Equipment (1974)
- Electronics Industry Production and Test Equipment (1974)
- Printing and Graphic Arts Equipment (1974)
- Electronic Components (1974)
- Metalworking and Finishing Equipment (1974)

For additional information on any of the above Global Market Surveys or any of the U.S. Department of Commerce export expansion programs and services, contact the Department's District Office nearest you (list on page 150).

CONTENTS

	Page
Preface	ii
I. Overview—World Market for Electronic Components	1
II. Country Market Surveys	12
Australia	13
Belgium	21
Brazil	29
France	37
Germany	44
Hong Kong	53
Israel	59
Italy	67
Japan	74
Mexico	85
Sweden	91
Switzerland	99
Taiwan	107
United Kingdom	115
III. County Market Briefs	126
Argentina	127
India	130
Korea	135
Netherlands	139
Spain	142
IV. U.S. Government Assistance Available to Exporters	144
Export Information and Overseas Business Opportunities Services (U.S. Department of Commerce)	144
Financing Export Sales (Export-Import Bank of the United States)	146
Export Credit Insurance (FCIA)	147
Tax Deferral Benefit Program for U.S. Exports (DISC)	149
Department of Commerce Contacts for U.S. Business	150
U.S. Department of Commerce District Offices	150
U.S. Trade Promotion Facilities Abroad	151
Office of Export Administration (U.S. Export Controls)	151
V. Schedule of Trade Promotional Events—1975 and 1976	152



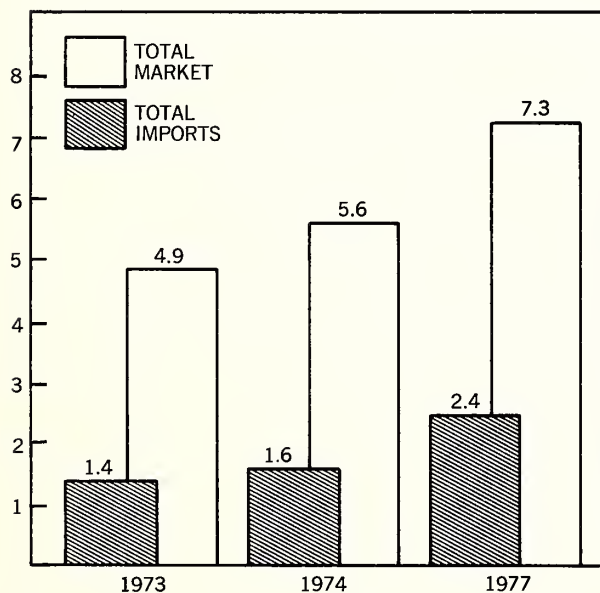
I. Overview—World Market for Electronic Components

Rapid expansion of foreign electronics industries, fueled by mushrooming worldwide demand for electronic end-products, is stimulating vigorous growth in demand for U.S. electronic components. Electronics manufacturers abroad are constantly designing and incorporating the latest of these versatile devices into an endless number of new industrial, commercial, military, and consumer products as they strive to take advantage of booming domestic and export markets. Consequently, overseas markets for electronic components are growing rapidly, not only in dollar volume and in areas of application, but also in amounts and varieties of components used as well as in numbers of users.

The findings of market research studies recently conducted for the Commerce Department's Office of International Marketing in 14 countries¹ reveal significant growth during recent years in demand for

¹ Australia, Belgium, Brazil, France, Germany, Hong Kong, Israel, Italy, Japan, Mexico, Sweden, Switzerland, Taiwan, United Kingdom.

Figure 1.—Aggregate Consumption and Imports of Product Category Electronic Components¹ in 14 Surveyed Countries² 1973, and projected 1974 and 1977 (in billions of U.S. dollars)



¹ Resistors, capacitors, color TV picture tubes, diodes and rectifiers, transistors, integrated circuits.

² Australia, Belgium, Brazil, France, Germany, Hong Kong, Israel, Italy, Japan, Mexico, Sweden, Switzerland, Taiwan, United Kingdom.

Source: U.S. Department of Commerce, Bureau of International Commerce market surveys.

Table 1.—Total Consumption and Total Imports of Product Category Electronic Components, by Country, 1973 and projected 1977

(in millions of U.S. dollars)

Country	1973		1977	
	Total Consumption	Total Imports	Total Consumption	Total Imports
Australia	59	22	131	83
Belgium	119	104	173	142
Brazil	63	23	98	21
France	288	129	412	154
Germany	902	399	1,189	510
Hong Kong	69	65	163	146
Israel	19	100	36	170
Italy	136	16	261	33
Japan	2,416	167	3,614	684
Mexico	25	4	41	6
Sweden	97	73	153	109
Switzerland	53	32	71	44
Taiwan	108	54	211	82
United Kingdom	572	248	706	262
Total	4,926	1,436	7,259	2,446

Source: U.S. Department of Commerce, Bureau of International Commerce market surveys.

the selected groups of components covered in this Survey, and indicate a continuation of this trend through 1977.

- Aggregate consumption of product category components in the 14 surveyed countries is expected to increase nearly 50% between 1973 and 1977, rising from \$4.9 billion to \$7.3 billion (see figure 1 and table 1).
- Total imports of product category components by the 14 countries are expected to surge to \$2.4 billion in 1977, an increase of more than 70% over the 1973 level of \$1.4 billion. The import share of total consumption should increase from 29% to 34% during the same period.
- Purchases of U.S.-made product category components by these countries continue to increase. Imports from the United States in 1972 reached approximately \$285 million, or 27% of the \$1.04-billion combined import market (see figure 2 and table 2). This compares with

PRODUCT CATEGORY DEFINITION

Electronic components covered in this Survey are basically confined to resistors, capacitors, color TV picture tubes, diodes and rectifiers, transistors, and integrated circuits. The term "product category" as used in this publication is limited to these six groups of components.

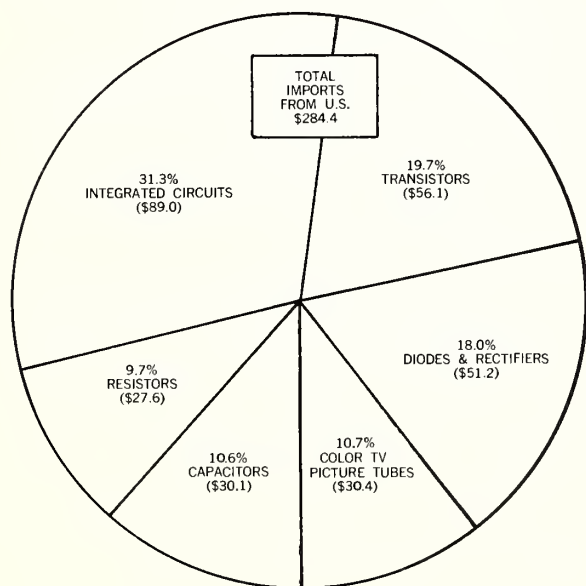
Table 2.—Total Consumption, Total Imports, and U.S. Share of Total Imports, of Product Category Electronic Components, by Country, 1972

(in millions of U.S. dollars)

	Total Consumption	Total Imports	U.S. Share of Imports value	Imports percent
Australia	53.6	18.5	5.7	30
Belgium	85.2	76.2	6.5	9
Brazil	47.9	21.7	6.4	29
France	260.2	125.6	42.0	33
Germany	608.5	269.6	76.0	28
Hong Kong	50.1	50.4	5.2	10
Israel	16.1	14.3	8.2	57
Italy	114.8	86.4	17.2	20
Japan	1,608.2	83.5	47.7	57
Mexico	21.9	4.2	1.9	46
Sweden	76.2	57.6	10.3	18
Switzerland	35.1	21.8	9.2	42
Taiwan	78.7	41.0	7.2	18
United Kingdom ..	472.0	168.2	40.9	24
Total	3,528.5	1,039.0	284.4	27

Source: U.S. Department of Commerce, Bureau of International Commerce market surveys.

Figure 2.—Composition of Aggregate Imports of Selected Groups of Electronic Components from the United States by 14 Surveyed Countries,¹ 1972 (in millions of U.S. dollars)



¹ Australia, Belgium, Brazil, France, Germany, Hong Kong, Israel, Italy, Japan, Mexico, Sweden, Switzerland, Taiwan, United Kingdom.

Source: U.S. Department of Commerce, Bureau of International Commerce market surveys.

purchases from the United States of \$218 million in 1969 and \$243 million in 1971. U.S. exporters can anticipate their combined sales to the 14 countries to approach a level of \$2 billion in 1977 if they retain their 1972 share (27%) of the combined import market. This may very well prove to be a conservative projection. American manufacturers have opened a technological gap of as much as two years in advanced product lines. They are in an excellent position to make further inroads into the rapidly expanding overseas markets. It should be noted that the current U.S. share of the combined import market is substantially higher than the 27% indicated. It does not include the high level of imports of electronic components from overseas-based manufacturing subsidiaries of U.S. firms.

Projected Consumption Pattern Shifts

Active Components.—The share of the combined market for product category components represented by active devices is expected to increase modestly from 65% in 1973 to 66% in 1977. The consumption value of such devices, however, is expected to grow by 50% in the same period (see figure 3).

Consumption of active product category components in the surveyed countries totaled \$3.19 billion in 1973. Integrated circuits represented \$851 million (17% of the total), discrete semiconductors accounted for approximately \$1.27 billion (26%), and color TV picture tubes comprised about \$1.07 billion (22%) (see table 3).

Table 3.—Total Consumption of Product Category Electronic Components in 14 Surveyed Countries,¹ by Active and Passive Groups, 1973 and projected 1977

(in millions of U.S. dollars)

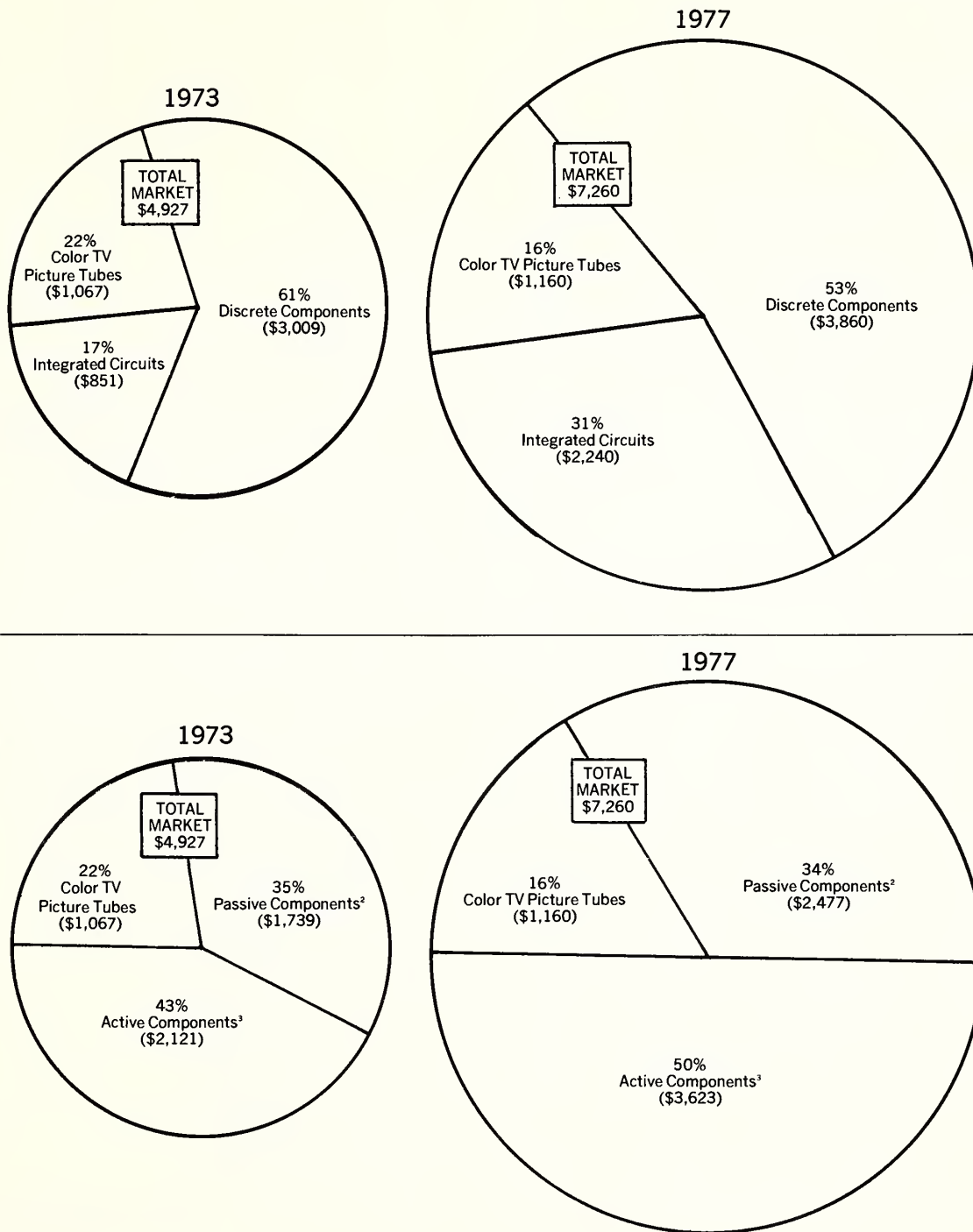
	1973		1977	
	Value	Market Share (percent)	Value	Market Share (percent)
TOTAL	4,927	100	7,260	100
Color TV picture tubes	1,067	22	1,160	16
Discrete semiconductor ²	1,270	26	1,383	19
Integrated circuits	851	17	2,240	31
Semiconductor total	2,121	43	3,623	50
Active components total	3,188	65	4,783	66
Resistors	680	14	908	12
Capacitors	1,059	21	1,569	22
Passive components total	1,739	35	2,477	34

¹ Australia, Belgium, Brazil, France, Germany, Hong Kong, Israel, Italy, Japan, Mexico, Sweden, Switzerland, Taiwan, United Kingdom.

² Transistors, diodes and rectifiers.

Source: U.S. Department of Commerce, Bureau of International Commerce market surveys.

**Figure 3.-Composition of Aggregate Consumption of Product Category
Electronic Components in 14 Surveyed Countries, ¹
1973 and projected 1977
(in millions of U.S. dollars)**



¹ Australia, Belgium, Brazil, France, Germany, Hong Kong, Israel, Italy, Japan, Mexico, Sweden, Switzerland, Taiwan, United Kingdom.

² Resistors and capacitors.

³ Integrated circuits, transistors, diodes and rectifiers.

Source: U.S. Department of Commerce, Bureau of International Commerce market surveys.

Table 4.—Consumption of Selected Groups of Electronic Components, by Country, 1973 and projected 1977 (in millions of U.S. dollars)

Country	Resistors		Capacitors		Color TV Picture Tubes		Diodes & Rectifiers		Transistors		Integrated Circuits	
	1973	1977	1973	1977	1973	1977	1973	1977	1973	1977	1973	1977
Australia	10.3	13.0	14.2	15.6	—	44.1	8.7	12.9	18.4	25.9	7.5	19.2
Belgium	15.6	20.7	33.2	44.2	35.3	60.9	10.4	11.3	18.2	20.0	6.8	15.9
Brazil	12.0	17.0	20.0	32.5	13.0	25.0	6.0	5.2	12.0	20.0	.2	3.4
France	51.2	68.0	74.4	92.9	48.4	90.8	26.0	44.4	48.4	66.8	40.0	49.6
Germany	153.6	174.0	192.0	284.0	230.0	272.8	90.4	118.8	88.0	63.2	148.0	276.0
Hong Kong	12.0	25.0	19.2	49.6	—	—	8.9	17.5	22.0	48.5	7.5	23.0
Israel	2.4	4.1	3.7	6.2	—	—	2.6	4.3	4.2	7.1	6.0	14.5
Italy	17.2	22.3	36.1	55.0	12.4	63.7	23.0	24.0	20.0	15.0	27.0	81.0
Japan	289.7	407.5	492.9	738.5	509.0	393.4	250.4	294.7	381.6	294.4	492.0	1,485.7
Mexico	3.1	4.8	6.7	10.6	7.7	13.0	2.7	3.0	4.2	6.3	1.2	3.4
Sweden	13.6	15.9	20.9	31.8	30.0	36.4	8.0	11.4	8.2	11.0	16.0	46.8
Switzerland	11.7	13.0	14.5	21.4	3.1	4.8	6.5	9.0	9.0	6.5	7.9	16.0
Taiwan	20.0	38.6	29.0	38.0	7.0	10.0	10.8	23.6	30.0	66.0	10.9	34.8
United Kingdom	67.4	83.7	102.3	149.0	171.5	145.0	76.8	88.4	74.4	69.7	79.6	170.2
Total	679.8	907.6	1,059.1	1,568.6	1,067.4	1,159.9	531.2	668.5	738.6	715.4	850.7	2,239.5

Source: U.S. Department of Commerce, Bureau of International Commerce market surveys.

The combined market for active product category components is predicted to climb to over \$4.78 billion in 1977, an average growth rate of nearly 10% a year from the 1973 level. Trade sources envision an average annual growth rate of 27% during the 1973-77 period for integrated circuits (IC's), and a little over 2% for both discrete semi-conductors and color TV picture tubes. At these growth rates, integrated circuits are expected to represent \$2.24 billion, or 31%, of the combined market in 1977; discrete semiconductors, \$1.38 billion (19%); and color TV picture tubes, \$1.16 billion (16%).

Passive Components.—The share of the combined market for product category components in the 14 surveyed countries represented by passive components is expected to decline 1% from 1973 to 34% in 1977. However, the value of total consumption of such components is expected to increase more than 42% during the same period. The drop in the market share reflects falling prices and the continued displacement of passive components by integrated circuits.

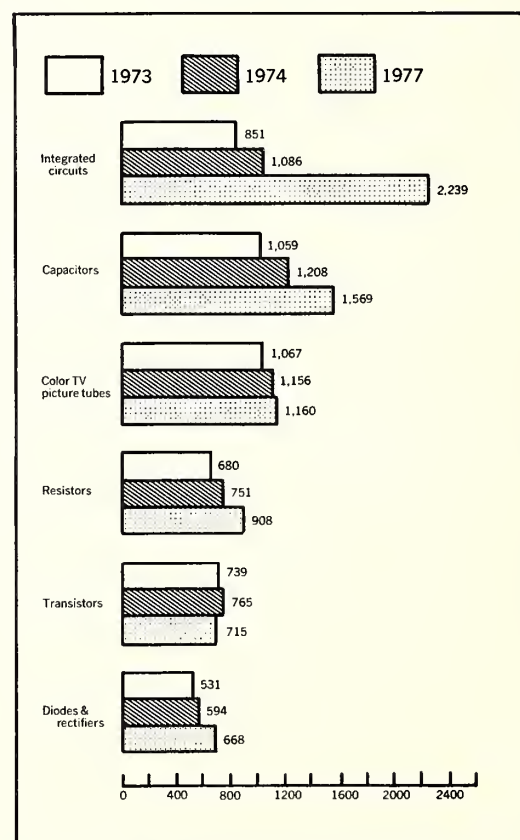
Consumption of passive components in the surveyed countries totaled roughly \$1.74 billion in 1973. Capacitors accounted for approximately \$1.06 billion of the total and resistors comprised \$680 million.

The combined market for passive components is expected to approach \$2.48 billion in 1977. If projected average yearly growth rates for capacitors and for resistors hold, capacitors will represent almost \$1.57 billion of the 1977 combined market, and resistors will account for about \$908 million.

Composition of the Market

Integrated Circuits.—Total 1974 consumption of integrated circuits in the 14 markets is expected to

Figure 4.—Aggregate Consumption of Product Category Electronic Components in 14 Surveyed Countries,¹ 1973 and projected 1974 and 1977 (in millions of U.S. dollars)



¹ Australia, Belgium, Brazil, France, Germany, Hong Kong, Israel, Italy, Japan, Mexico, Sweden, Switzerland, Taiwan, United Kingdom.

Source: U.S. Department of Commerce, Bureau of International Commerce market surveys.

reach \$1.09 billion, or 28% over 1973's \$851 million. An expected 27% average annual growth rate points to a \$2.24-billion combined market in 1977 (see figure 4 and table 4).

The combined IC import market is projected to reach \$331.4 million in 1974, compared with \$330.3 million in 1973. Imports are expected to surge to nearly \$1.05 billion in 1977, a 215% increase over the estimated 1974 level (see table 5).

The United States commands a dominant share of the combined import market for integrated circuits. IC imports from the United States in 1972 totaled \$89 million, or 47% of the \$188-million combined IC import market (see table 6). American producers of IC's are in an enviable position because of their technological lead. They should be the chief beneficiaries of the explosive growth predicted for imports of such devices in the surveyed markets during the 1974-77 period.

The types of integrated circuits with highest sales potential in the 14-country marketplace include:

- Monolithic digital integrated circuits, including:
 - MOS (metal oxide semiconductor), particularly MSI/LSI memory circuits
 - CMOS (complementary metal oxide semiconductor)
 - TTL (transistor-transistor logic)
 - ECL (emitter-coupled logic)
- Monolithic linear integrated circuits
- Hybrid integrated circuits, thick film and thin film

In the process of developing end products with solid state circuitry, some manufacturers in the fast-paced foreign electronics industries are expected to move directly to the production of equipment using integrated circuits, bypassing the discrete components stage. Nevertheless, demand in the surveyed countries for discrete devices is expected to remain

strong through the 1970's. Although the share of the combined market represented by discrete product category components is expected to decline from 61% in 1973 to 53% in 1977, an advance is forecast in the value of total consumption of such components from \$3.01 billion to \$3.86 billion during the same period (see figure 3).

Transistors.—The 1974 transistors market in the 14 countries is expected to total \$765 million, up \$26 million from 1973 figure. A decline to a value of \$715 million is expected in 1977, however, as a result of transistor price erosion and the shift to IC's.

Imports of transistors by the 14 countries, totaling \$257.3 million in 1973, are expected to reach \$278 million in 1977. The 1973 import share of the combined market was 38%, and little variance is anticipated in this share through 1977.

American transistor manufacturers should find good sales opportunities in all the surveyed countries despite the expected decline in the combined market arising from falling transistor prices and their displacement by IC's. U.S. exporters in 1972 accounted for \$56 million, or 26% of the transistor import market. They should continue to hold a leading import market share as demand for transistors narrows to higher technology devices. Demand should continue to be strong for specialized high-technology devices developed in the United States, particularly for transistors with high frequency, high power, low noise, and high power field effect.

The types of transistors with highest sales potential in the 14-country marketplace include:

- Silicon small signal
- Silicon power
- Silicon switching
- Field effect
- Microwave

Table 5.—Imports of Selected Groups of Electronic Components, by Country, 1973 and projected 1977 (in millions of U.S. dollars)

Country	Resistors		Capacitors		Color TV Picture Tubes		Diodes & Rectifiers		Transistors		Integrated Circuits	
	1973	1977	1973	1977	1973	1977	1973	1977	1973	1977	1973	1977
Australia	3.3	5.8	5.7	7.6	—	44.1	4.1	4.7	5.7	10.6	3.9	10.2
Belgium	14.6	17.0	33.9	50.4	26.8	39.5	8.5	7.9	15.8	16.7	4.7	11.0
Brazil	2.5	1.0	4.5	6.0	2.0	2.1	5.1	1.7	8.5	7.5	.2	2.6
France	15.0	17.6	24.0	26.2	31.4	43.6	12.2	12.2	26.0	28.0	20.0	26.0
Germany	38.0	44.0	47.0	67.0	85.0	92.0	68.0	83.2	62.0	48.0	98.8	176.0
Hong Kong	11.0	17.0	14.2	39.0	—	—	2.9	8.0	32.0	65.0	5.0	17.0
Israel	2.3	3.7	2.9	4.8	—	1.0	—	—	3.5	6.0	5.3	12.8
Italy	19.5	24.2	18.3	28.1	11.0	40.0	13.0	10.0	18.0	13.0	20.0	55.0
Japan	10.6	24.5	11.7	25.3	.3	2.8	11.6	12.5	20.0	15.1	113.2	603.8
Mexico	1.4	2.1	.8	1.3	.1	—	.9	1.0	.7	1.1	.5	1.1
Sweden	10.9	12.5	9.1	15.4	—	—	6.1	7.7	7.7	10.2	9.3	26.6
Switzerland	3.4	4.0	9.6	14.0	3.1	4.8	3.5	5.0	6.8	4.8	5.6	11.2
Taiwan	7.5	9.0	20.0	20.0	7.0	10.0	6.6	12.0	11.0	16.0	1.9	14.8
United Kingdom	23.3	31.0	39.5	65.0	78.0	26.0	25.6	29.0	39.6	36.0	41.9	75.0
Total	163.3	213.4	241.2	370.1	244.7	305.9	167.1	194.9	257.3	278.0	330.3	1,043.1

Source: U.S. Department of Commerce, Bureau of International Commerce market surveys.

Table 6.—Imports from the United States, and U.S. Share of Total Imports, of Selected Groups of Electronic Components, by Country, 1972
(in millions of U.S. dollars)

	Resistors		Capacitors		Color TV Picture Tubes		Diodes & Rectifiers		Transistors		Integrated Circuits	
	Value	Percent	Value	Percent	Value	Percent	Value	Percent	Value	Percent	Value	Percent
		share		share		share		share		share		share
Australia	438	16	884	17	—	—	1,553	56	1,553	29	1,271	43
Belgium	800	7	900	4	500	2	700	9	1,700	14	2,000	67
Brazil	475	22	382	9	1,900	32	1,042	22	2,253	30	300	60
France	4,400	31	6,000	25	3,000	11	4,400	34	13,000	48	11,200	57
Germany	7,100	27	5,500	16	13,700	24	19,900	45	10,200	19	19,600	30
Hong Kong	346	3	166	2	8	40	714	30	2,865	11	1,102	43
Israel	756	37	1,258	51	—	—	1,350	60	1,787	55	3,010	70
Italy	3,374	18	1,972	12	792	10	2,600	21	2,244	13	6,186	41
Japan	3,700	62	1,859	26	83	92	5,925	71	6,976	54	29,125	59
Mexico	509	40	71	10	88	53	536	58	384	62	308	76
Sweden	1,300	14	1,500	21	700	3	1,300	30	2,500	37	3,000	42
Switzerland	200	8	800	12	3	—	1,600	73	4,600	74	2,000	75
Taiwan	259	4	4,854	31	—	—	875	16	500	7	710	79
United Kingdom ...	3,900	19	4,000	15	9,600	20	8,700	46	5,500	19	9,200	36
Total	27,557	21	30,146	17	30,374	18	51,222	40	56,063	26	89,012	47

Source: U.S. Department of Commerce, Bureau of International Commerce market surveys.

Diodes and Rectifiers.—Overall expenditures for diodes and rectifiers in the 14 markets are expected to rise from \$531 million in 1973 to \$594 million in 1974. Based on a predicted 12% average annual growth rate, the combined market is projected to reach \$668 million in 1977.

The 1974 combined import market for diodes and rectifiers is estimated at \$177 million, up \$10 million from 1973. Imports are forecast to reach \$195 million in 1977. The import share of total consumption in 1973 was 31%, with little change expected in this share through 1977.

Purchases in 1972 of American-made diodes and rectifiers by the 14 countries totaled \$51 million, or 40% of the \$127-million combined import market for these devices. U.S. exporters can expect to continue as a major source of diodes and rectifiers for the electronics industries in the surveyed countries. Growing requirements in these countries for advanced diodes and rectifiers, coupled with the need to establish additional sources for components in short supply, ensure good prospects for further market penetration by American firms.

The types of diodes and rectifiers with highest sales potential in the 14-country marketplace include:

- Silicon diodes
- Signal diodes
- Zener diodes
- Microwave diodes
- Diode assemblies
- Silicon rectifier diodes
- High power rectifiers

Color TV Picture Tubes.—The 1974 combined market for color TV picture tubes in the 14 countries is expected to exceed \$1.15 billion, an increase of

nearly \$90 million over the 1973 level. Total consumption is expected to reach \$1.16 billion in 1977.

Although aggregate imports by the 14 countries in 1974 are not expected to show significant growth over the 1973 level of \$245 million, the combined import market bears close watching. Growing consumer affluence, coupled with the planned introduction of color TV transmission in several of the surveyed countries during the next few years, is expected to open up new markets to foreign-made color TV picture tubes. Since local production in these countries is non-existent or in an early stage of development, demand over the next few years should be satisfied in large part by imports. The combined 1977 import market is forecast to exceed \$305 million, an increase of more than 20% over the estimated 1974 level. The import share of the combined market is expected to increase from almost 23% in 1973 to over 26% in 1977.

Total 1972 imports from the United States of color TV picture tubes by the 14 countries amounted to more than \$30 million, or nearly 18% of the import market for such tubes. In some of the surveyed countries consumption of color TV picture tubes has been rising faster than local production in recent years, thus generating expanding import markets. This makes prospects for increased sales of U.S.-made color TV picture tubes especially promising in the years just ahead.

The types of color TV picture tubes with highest sales potential in the 14-country marketplace include:

- 110° deflection thin neck tubes, used primarily in large-screen TV receivers
- Precision in-line (PIL) bonded yoke tubes, used mostly in the smaller TV sets.

Capacitors.—Aggregate consumption of capacitors in the surveyed countries is expected to climb from a 1973 level of \$1.06 billion to almost \$1.21 billion in 1974. Predicted increases averaging 9% annually from the estimated 1974 level would raise the combined market to nearly \$1.57 billion in 1977.

Imports of capacitors by the 14 countries, totaling \$241 million in 1973, are expected to advance to about \$278 million in 1974. The 1977 combined import market is projected at \$370 million, or almost a 33% increase over the estimated 1974 level. Imports are expected to retain their 1973 share (23%) of the combined annual market through 1977.

The United States in 1972 accounted for \$30.1 million of the \$179.5-million combined capacitor import market. The capacitor markets in most of the surveyed countries are presently characterized by supply shortages, due to the recent upsurge in output of industrial/commercial and consumer electronic end products. With demand outstripping local production, users in the surveyed markets are looking increasingly to foreign sources for their capacitor requirements. American suppliers who can meet user delivery requirements are in a good position to capture a larger share of the rapidly expanding combined capacitor import market.

The types of capacitors with highest sales potential in the 14-country marketplace include:

- Fixed electrolytic
- Fixed ceramic
- Fixed tantalum
- Fixed film
- Fixed paper
- Aluminum electrolytic
- Tantalum electrolytic
- Ceramic chip
- Multilayer ceramic chip
- Variable
- Microvariable

Resistors.—The combined market for resistors is forecast to advance 21% during the 1974-77 period, rising from \$751 million to \$908 million. By comparison, resistor purchases in 1973 totaled \$680 million.

Total purchases of foreign-made resistors by the 14 countries in 1974 are projected at \$181 million, up from \$163 million in 1973. The combined import market is expected to exceed \$213 million in 1977, an increase of almost 33% over the estimated 1974 level. Imports in 1973 accounted for 24% of the total resistor market and this import share probably will remain stable through 1977.

U.S. exporters, with \$27.5 million in total sales to the 14 countries in 1972, accounted for a 20.6% share of the combined import market for resistors in that year. Makers of precision instruments, telecommunications equipment, and other specialized industrial/commercial electronic equipment in the

surveyed countries require resistors of closer tolerance, higher quality, greater reliability, and more advanced design than those available from local production. Their expanding requirements for advanced resistors for specialized applications will send imports up sharply, providing opportunities for increased U.S. exports.

The types of resistors with highest sales potential in the 14-country marketplace include:

- Fixed thick film
- Fixed thin film
- Fixed carbon composition
- Fixed wirewound
- Variable wirewound
- Metal film
- Potentiometers

Other Electronic Components.—Among the types of electronic components outside the product category considered as having high sales potential in the 14-country marketplace are the following:

- Electron tubes, including high-power transmitting tubes and receiving tubes for industrial and military applications
- Relays and switches
- Connectors, including coaxial, circular, rack-and-panel, printed circuit
- Inductors
- Light-emitting diodes
- Liquid crystal
- Thermistors
- Varistors
- Photosensors
- Quartz crystals
- Thyristors, unidirectional and bidirectional
- Printed circuits

User Markets Expanding

The downward trend in prices for solid state electronic components during past years is attributable primarily to technological advances and declining production costs. This has had a significant impact on the expansion of existing end markets and the opening up of new ones in the 14 surveyed countries. Electronic components are pervading all segments of the economies of these nations, just as they already have in the United States. These devices have found thousands of applications in the telecommunications, data processing, control and instrumentation, automotive, medical, avionics, and consumer electronic products industries.

Foreign electronic industries are entering a period of rapid transition from the use of components in their maturing or declining life cycle stages to the widespread application of the advanced devices introduced in the last few years. Demand for many of the more advanced components in the surveyed countries is outpacing local production, a factor which makes import prospects especially promising.

Foreign electronics industries will depend in large part on U.S. manufacturers for specialized high performance components, especially IC's. This is because American manufacturers have made significant progress down the technology and production learning curves, a factor permitting them to set competitive export prices in spite of relatively high labor costs. On the other side of the coin, foreign electronic components manufacturers are more cautious than their U.S. counterparts with regard to making plant investments to increase productivity. Although the United States is among the countries where components demand has outpaced supply, American producers, because they have the highest degree of automation in most product lines, are still able to offer shorter lead times for delivery of many of the more complex types of components than their foreign competitors. In short, technology, pricing, and shorter lead times are the competitive conditions that foster purchases of electronic components from the United States.

The largest and fastest growing markets for components in the industrial/commercial equipment sector in most of the surveyed countries are the telecommunications and data processing products industries. In the consumer products sector, the television receiver industry is the largest user of electronic components. Other high-technology consumer electronic industries with promising growth potential are the automotive, calculator, and clock and watch industries.

Telecommunications Equipment Industry

A continued high level of government spending to expand and upgrade telecommunications networks is indicated in virtually all the surveyed countries. Consequently, telecommunications hardware manufacturers in these nations are planning major expansion of their production. The electronic component requirements of these manufacturers are already substantial. Expanded production likely will more than double their needs during the next 5 years.

In all the surveyed countries, the government either owns or holds a controlling interest in the telecommunications companies. Work is proceeding on a major scale in most of these countries on the installation of new voice and data communications networks and the expansion and modernization of existing networks required to meet the urgent needs of telephone subscribers and computer users. The replacement of electromechanical telephone exchanges with computer-controlled stored-program exchanges, the greater use of electronic switching equipment and pulse code modulation (PCM) transmission systems, the increased production of private telephone systems (PAX, PABX, PALX), and the introduction of pushbutton telephones—all these developments are generating an enormous demand in the 14 countries for high technology electronic

components.

Production by Germany's telecommunications equipment industry, for example, is expected to approach \$3.5 billion in 1977. This would be more than double the 1972 level of \$1.5 billion. Planned expenditures by the British Post Office Corporation for expansion and modernization of the United Kingdom's telecommunications system during the period 1973-77 are placed at \$5 billion. Production by Britain's telecommunications industry is forecast to surge to over \$1.3 billion in 1977, more than 80% over 1972 output. In Italy, public investment in telecommunications during the same period is expected to total \$5.6 billion. Outlays by the Italian national telephone company for new capital equipment in 1973 was estimated at \$1 billion. Annual output of the country's telecommunications equipment industry is expected to nearly double between 1972 and 1977, rising to over \$1 billion. In Brazil, where there has always been an acute shortage of telephones, the Government has begun a major expansion of the telecommunications networks. This includes interurban microwave systems that will link the state networks to the country's interstate/international grid. Brazil plans to switch in the near future from the present system of crossbar exchanges to a more sophisticated semielectronic, or hybrid, exchange system. The country's expansion plans during the 1975-80 period include the installation of 1 million new telephones a year at a cost of approximately \$5 billion. This implies a significant upswing in demand for imported electronic components by the Brazilian telecommunications equipment industry, since local production obviously will not be able to meet every specialized need.

Computer and Related Equipment Industry

Manufacturers of computers and related equipment in the surveyed countries are expected to require vastly larger quantities of advanced electronic components during the next 5 years. Underlying this optimistic forecast are their plans to expand and diversify their production of computer systems, minicomputers and computer peripherals, as well as the increasing amount of new equipment that is being configured with semiconductor memory.

The combined annual production of the computer industries in the 7 West European countries surveyed is expected to advance 75% in value between 1973 and 1977, rising to nearly \$7.7 billion. In Japan, the fastest growing subsector within the industrial/commercial equipment sector, in terms of production as well as capital investment, is the computer and related equipment industry. Production is forecast to increase more than three times, from \$1.3 billion in 1972 to \$4.5 billion in 1975. Combined capital investments in 1974 by the country's three major manufacturers (Fujitsu, Nippon Electric Corp. and

Hitachi) are expected to approximate \$115 million. Fujitsu uses IC's in all its EDP hardware circuitry, while Hitachi and other manufacturers will replace magnetic core elements with IC's on a model-by-model basis over the next 2 years.

German mainframe manufacturers are using new types of IC's such as the ECL 10K type in memories of large and medium-size computers.

Prices of semiconductor memories have declined sharply, enabling them to seriously challenge magnetic core, which has been and still is the predominant memory in computers, add-on memory systems, and minicomputers. Foreign computer makers are expected within the next 5 years to build more main memories with MOS IC's than with magnetic cores. An ever-widening field of applications is foreseen in overseas EDP equipment industries, not only for IC's but for all electronic components, as prices continue to drop because of technological gains and increased productivity.

Television Receiver Industry

Rises in disposable personal income and personal expenditures, coupled with the ready availability of credit, have created a huge demand in the surveyed countries for televisions, especially color sets. The anticipated rapid expansion in production of color TV sets to meet this demand should assure increased import markets for electronic components in these countries. The planned inauguration of color TV broadcasting in Australia early next year, for example, is expected to generate more than a threefold increase in Australian consumption of electronic components during the 1973-77 period. Annual purchases of components by the country's television receiver industry are expected to rise from \$43 million to \$144 million during the 5-year period. Color TV set manufacturing is expected to account for \$114 million of the projected 1977 consumption figure. The Australian market for color TV is predicted to climb from 20,000 sets in 1974 to 360,000 in 1977, resulting in a \$320-million to \$400-million market in the latter year.

Countries with sizeable television receiver industries are becoming more reliant on imports for their advanced components requirements as cost pressures and labor shortages reduce the domestic electronic components industry's capacity to meet growing local demand. Imports of color TV picture tubes alone by Germany's expanding TV set industry rose from \$21.4 million in 1969 to \$56.4 million in 1972. The U.S. share of imports during the same period rose from 10% (\$2.2 million) to about 24% (\$14 million). Germany's output of color TV sets in 1972 was \$653 million and is expected to more than double to almost \$1.5 billion in 1977. The number of sets produced is seen increasing from approximately 1.5 million sets to about 2.5 million sets during this period.

The use of solid state circuitry in television receivers is rising steadily in a number of the surveyed countries. In Brazil, for example, approximately 45% of the sets made in 1972 had some transistors. It is expected that by 1977 half of all Brazilian-made sets will have integrated circuits. In fact, the trend to all solid-state TV is accelerating in some of the surveyed countries at a faster pace than in the United States. Nearly all German-made TV receivers, for example, are 100% solid-state, using an average of 10 IC's per set. Single chip MOS IC's are being used for touch tuning. Some manufacturers are currently using a transistorized audio output stage, and all will probably use IC's in this stage as circuits with higher output become more readily available. Ultrasonic remote control modules, employing MOS IC's, are used in some high quality sets. Thick film circuits were introduced in 1974 models and active hybrid IC's are expected to be introduced in the 1975 models.

Automotive Industry

Expected rapid growth in foreign car production and in the electronic content of motor vehicles should result in sharp increases in expenditures by overseas automakers for automotive electronics during the remainder of the 1970's. Total motor vehicle production in Western Europe, for example, is forecast to rise from about 12 million cars in 1973 to an estimated 14 million in 1977. During the same period, the level of electronic content, excluding radios and tape-players, is projected to increase from under \$10 per vehicle to over \$25 per vehicle.

Rising foreign government standards for car safety and environmental control will be a strong contributing factor to the expected rapid expansion of the automotive electronics markets abroad. Because of their substantial exports to the United States, foreign automakers are finding it necessary to accelerate use of electronic systems and devices affecting the performance, safety, and convenience features of their cars. Such upgrading is necessary in order to meet stringent U.S. Government standards and to successfully compete with their American counterparts in the U.S. market.

Foreign automakers offer improving prospects for the application of IC technology in the following automotive systems: fuel injection (ROM/PLA/custom-microprocessor); antiskid braking (CMOS/bipolar digital and bipolar linear); seat-belt interlocks (CMOS/bipolar custom); safety and warning devices ("photo" switches and MOS or bipolar logic); electronic ignitions (proximity switch devices involving thyristor trigger output); electronic transmission controls (MOS or bipolar digital IC's); tachometers/odometers (bipolar digital counter); and alternator regulators (monolithic IC's).

AB Volvo of Sweden has recently recruited 60 engineers to staff a new department for the develop-

ment of automotive electronics. The company could become a substantial buyer of electronic components, particularly if it begins producing its own automotive electronic systems.

The increasing importance of solid state technology in foreign automotive industries makes it advisable that U.S. components manufacturers with a new cost-effective and reliable device or module for use in cars should lose no time in approaching all the automakers in the surveyed countries in a bid to gain a strong foothold in those markets. If they are able to provide what the foreign auto companies want, the rewards could be substantial.

Calculator Industry

The latest buying surge in the world electronics marketplace involves calculators, particularly "pocket" or "handheld" calculators. A mass market for these personal-type calculators is expected to develop in many nations of the world as prices decrease. Overseas manufacturers are striving vigorously to expand their production to take advantage of the anticipated surge in world demand for these calculators. The fastest growing industry in the consumer products sector in Japan, for example, is the manufacture of electronic desktop and pocket calculators. Production increased between 1967 and 1972 at a 60% average annual growth rate, soaring from \$32 million to \$355 million. Exports expanded an average of more than 90% annually during the same period, skyrocketing from \$9 million to \$236 million. The overseas market for Japanese calculators expanded so rapidly that manufacturers were unable to organize sales networks. Consequently, foreign sales under the buyer's brand name are common. Sharp calculators, for example, are sold in the United States under the Burroughs name, Cannon calculators under the Monroe name, and Hitachi calculators under the Frieden label.

Having pioneered and developed the first electronic calculator in the world in 1964, Japanese manufacturers possess a superior technological capability and a marked time advantage in placing new products on the market. In the highly competitive environment of electronic calculator production, Japanese manufacturers realize they must design the latest components into their products if they are to remain competitive in world markets. Practically all of Japan's calculator manufacturers, including the 16 producers of pocket calculators, utilize LSI circuitry in their products. Since the rising demand for IC's for calculators and other electronic end-products cannot be met by local production, the market share supplied by imports is expected to increase, climbing from 32% (\$67.2 million) in 1971 to 40% (\$604 million) in 1977. Purchases of American-made IC's, totaling \$29 million and accounting for 59.2% of the import market in 1972, are expected to rise sharply in the years ahead,

since U.S. manufacturers are the major source of MOS/LSI's used in Japanese calculators.

Germany's fast-developing pocket calculator industry is another growth market for electronic components. The country's production of pocket calculators is predicted to expand substantially from \$3 million (45,000 units) in 1972 to \$32 million (350,000 units) in 1977. Single chip MOS IC's are being used in German-made pocket calculators. The United States is the leading foreign supplier of IC's to Germany, accounting for 36% (almost \$20 million) of the 1972 import market. This puts American suppliers in an excellent position to capitalize on the pocket calculator industry's growing need for imported IC's.

Clock and Watch Industry

Foreign-made clocks and watches are expected to stimulate major business opportunities for U.S. exporters of reliable, high quality electronic components during the next 5 years. Applications for electronic devices in overseas horologic industries have emerged from the experimental to the commercial stage. As electronic clock and watch production volume and competition increase, and production costs decrease, prices for such timepieces will continue spiraling downward; this should result in rapid market growth.

Now that solid-state technology provides a means of producing highly accurate clocks and watches on a production line basis and eliminates the need for highly skilled labor, conversion from mechanical to electronic timepieces is expected to accelerate in the surveyed countries that have horologic industries, notably Switzerland, Germany, and Japan.

Production of electronic watches in Japan, for example, began in the summer of 1972, and 2.5 million units were manufactured in 1973. The industry expects 40% of all wristwatches made in Japan to be electronic by 1978. One of the principal uses of C/MOS devices in Japan will be for wristwatches. Seiko (Sheikosha and Co., Ltd.) digital watches with liquid crystal displays were scheduled to be introduced in the first half of 1974. Matsushita Electric Trading Company is about to market a liquid crystal clock.

Switzerland's watch and clock industry supplies 45% of the world's watches and 4% of its clocks. It produced some 80 million units in 1972 valued at \$708 million. Production in 1977 is expected to increase to 90 million units, worth close to \$1.1 billion. Current annual output of electronic watches and clocks is estimated at over 2 million units. Starting from its current small base, a rapid rate of expansion is anticipated in consumption of electronic components in the Swiss horologic industry. Annual consumption, placed at \$2 million in 1972, is expected to skyrocket to \$50 million in 1976 and to expand even more rapidly in the years there-

after. Demand in the Swiss horologic industry is currently strongest for C/MOS integrated circuits. Rapidly expanding production of digital timepieces is expected to generate a sharp rise in demand for microvariable capacitors for tuning quartz oscillators in the years just ahead.

Germany is another important watch producer and the largest manufacturer of clocks in the world. Output of these two products combined was \$230 million in 1972. It is predicted to climb to almost \$350 million in 1977. Clock production was over 32 million units in 1972 and may reach 37 million units in 1977. Production of watches is forecast to rise from 8.3 million units to about 10 million units during the same period.

Conclusion

Enormously increased production is required to meet vastly increased world demand for electronic components. U.S. components manufacturers will find excellent sales opportunities in the surveyed countries for many of their more advanced products, since strong import growth is projected as a complement to local production in meeting the rapidly increasing demand.

U.S. components makers currently command a dominant position in the world marketplace. This dominance is attributed mainly to their technological leadership, their ability to convert research discoveries into productivity, and their aggressive pricing policies. Foreign components producers, on the other hand, are still encountering problems in mass production technologies and production costs. Further development is necessary if they are to resolve present problems regarding the reliability of their products, since many foreign manufacturers find their production blocked in the testing phase. Until these technological and production problems are

dealt with, then, foreign electronics firms will continue to rely on U.S. suppliers for highly sophisticated components. Moreover, the position of American electronics firms in foreign electronics industries as investors, licensors and technical advisors is another reason why U.S.-made electronic components are generally favored by purchase decision-makers abroad.

The discrepancy between foreign and American technology in the highly complex devices, notably IC's, arises partly from the paucity of R&D funds for basic research currently available to foreign component firms. Another major factor is the small size of markets for high technology components in other countries, compared to the United States. This makes it less feasible economically for foreign manufacturers to tool up for new technology market lines. Furthermore, foreign producers usually make major investments in advanced componentry production only after a U.S. originator has marketed a new product and proved its commercial success.

The development of semiconductor computer memories demonstrates the technological disparity between the United States and its foreign competitors. For example, the U.S. market for 1,024-bit memories has been established, and 4,096-bit memories have been developed and successfully marketed. Although components manufacturers in some of the industrially advanced countries have developed the technology for similar memory devices, they have yet to fully commercialize these products. Notwithstanding the fact that American producers of electronic components have outpaced their foreign rivals in technology and manufacturing capacity, sustaining their leadership position in the world marketplace will require aggressive business skills, innovative marketing techniques, and extensive customer applications assistance and product tailoring.

II. Country Market Surveys

Surveys on 14 primary country markets for selected groups of electronic components are contained in this section. These surveys are based on comprehensive market studies conducted for the U.S. Department of Commerce in the respective countries.

Electronic components covered in the *Country Market Surveys* are basically confined to the following six groups of components:

- Resistors
- Capacitors
- Color TV picture tubes
- Diodes and rectifiers
- Transistors
- Integrated circuits

Parameters of the "Country Market Surveys" cover:

Market Size

- Narrative and statistical presentation—historical and projected—of size of market for product category components, imports, and the U.S. share of imports.

Sales Opportunities

- Identification and brief discussion of specific components within the product category which are expected to have high sales potential for U.S. exporters.
- Causal factors for future growth in demand for groups and/or individual components within the product category.

Selected End-User Industries

- Delineation of current and projected market shares of the three major components-using sectors (industrial/commercial equipment sector; consumer products sector; and military equipment sector).
- Size and structure of major user sectors/subsectors, and expected demand trends for electronic components.
- Profiles of important user subsectors (industries) in each of the major market sectors.
- Technological levels and trends within user sectors/subsectors with respect to components that are most in demand.

The Competitive Environment

- Size and composition of domestic production and exports of product category components and the domestic industry's ability to meet the needs of the local market.
- Comparative assessment of the competitive position of U.S. suppliers vis-a-vis domestic and foreign competitors in the market.
- Factors inhibiting U.S. competitive position, including pertinent government policies and programs, import duties, non-tariff trade barriers, etc.

Technical Requirements

- Electrical power supply characteristics.
- System of weights and measures.
- Technical standards and requirements where applicable.

Australia

The introduction of color TV transmission in Australia, scheduled for March 1975, is expected to spark strong demand for a wide range of electronic components. The color television industry alone is projected by 1977 to provide a \$114-million annual market for electronic components.

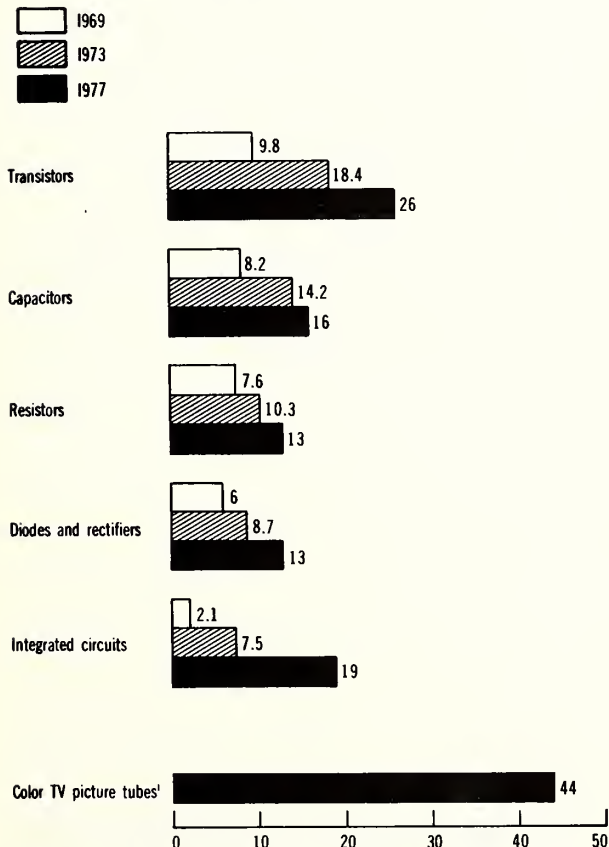
The Australian market for the selected groups of electronic components covered in this report is forecast to grow at an average annual rate of 22% between 1973 and 1977, rising from \$59.1 million to more than \$130 million (see table 1). This represents a marked rise over the 1969-72 period, when purchases of electronic components increased at an average annual rate of almost 17%, climbing from \$33.7 million to \$53.6 million.

Imports of electronic components within the product category grew an average of 19% per year between 1971 and 1973, rising from \$15.3 million to \$21.7 million. Spurred by the expected rapid expansion in the use of advanced components, imports are forecast to rise an average of almost 40% during the 1973-77 period, reaching \$83 million in the latter year. Trade sources forecast that imports in 1977 will represent about 64% of total Australian consumption of product category components, compared to a 37% share in 1973.

The predicted sharp rise in demand for advanced components should lead to increased imports from the United States, which is the world leader in the production of new-technology semiconductors. Purchases of American-produced components rose moderately from \$5.3 million in 1969 to \$5.7 million in 1972 (see table 2). Imports of U.S.-made components in the latter year accounted for 30%

Australia: Size of market for selected groups of electronic components, 1969-77

(in millions of U.S. dollars)



¹ Inauguration of color television broadcasting is planned for March 1975.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

Product Category Definition

Electronic components covered in this survey are basically confined to resistors, capacitors, color TV picture tubes, diodes and rectifiers, transistors, and integrated circuits.

The term "product category" as used in this publication is limited to these six groups of components.

**Australia—Selected Indicators
(FY 1972)**

Gross national product:	\$42.2 billion
Population:	13,000,000
Total country imports:	\$4,688 million
Imports from U.S.	
(w/share of total):	\$1,022 million (21.8%)
Total country exports:	\$5,727 million
Exports to U.S.	
(w/share of total):	\$722 million (12.6%)
Exchange rate	
(May 1974):	0.67 Australian dollars=US\$1

of the \$18.5-million import market. Sustained by a continuing U.S. lead in electronic components technology, U.S.-origin components should maintain their approximate one-third share of the import market and reach a level of \$25 million in 1977.

Sales Opportunities

The Australian electronics industry is entering a period of expanded production and modernization. Besides the impending introduction of color TV transmission, other factors such as the upgrading of the country's telecommunications systems and the use of more electronic control systems by the automotive industry are major reasons behind the strong growth forecast for the electronic components market.

A market research study recently conducted in Australia for the U.S. Department of Commerce, Office of International Marketing reveals that favorable sales opportunities exist for American exporters of the following electronic components:

Color TV picture tubes.—Color TV picture tubes are expected to become the largest-selling single item within the product category following the inauguration of color TV transmission in 1975. From an anticipated 1974 base of \$5.9 million, imports should rise to more than \$44 million in 1977, reflecting a strong potential market for U.S. manufacturers.

The Australian market for color TV sets is forecast to reach 105,000 units in 1975; 220,000 in 1976; 360,000 in 1977. Since local production of color TV picture tubes is in an early stage of development, demand over the next few years is expected to be satisfied in large part by foreign suppliers. The market for black-and-white sets is forecast to decline from 400,000 in 1973 to about 225,000 in 1977.

Sales of microwave tubes are also expected to experience rapid growth during the next 5 years. These tubes are being used increasingly in communications, radar, medical, and other equipment operating at ultra-high frequencies.

Transistors.—The Australian market for transistors increased 26% from \$14.6 million in 1971 to \$18.4 million in 1973. The expected continued rapid rise in demand for transistors should boost sales to nearly \$26 million in 1977.

Imports in 1973 totaled \$5.7 million, or 30% of the market, and are projected to reach \$10.6 million in 1977. Purchases of U.S.-made transistors in 1972 reached \$1.6 million, or 29% of the \$5.2-million import market. Transistors offering particularly good sales potential to American manufacturers include:

- Small signal transistors
- Power transistors
- General-purpose transistors
- Field effect transistors

Silicon transistors represent a high-growth market in Australia, as germanium transistors have become obsolete. Sales of silicon transistors ranged between \$2.5 and \$3 million in 1973. Local trade sources forecast a rapid rise in demand for these devices by manufacturers of consumer electronic products and telecommunications equipment during the next 5 years.

Sales of silicon power transistors also have high growth potential in Australia, where television and telecommunications equipment producers already are substantial purchasers of such transistors. The anticipated use of semiconductor devices in automotive ignition systems also should have an expansionary effect on the power transistor market.

General-purpose transistors are in the mature stage of their product life cycle and are expected to be replaced by integrated circuits in the next 3 to 5 years. Particular interest in field effect transistors is expected to be shown by consumer products manufacturers in the years just ahead. Australian users have had difficulty meeting their needs for silicon transistors of this and other types due to a worldwide shortage, and additional supplies would be welcome.

Capacitors.—The Australian market for capacitors is expected in 1977 to reach \$15.6 million, up from \$14.2 million in 1973 and \$11.2 million in 1971.

Imports during the 1973-77 period should climb 33%, going from \$5.7 million to \$7.6 million. Purchases of American-produced capacitors in 1972 totaled \$884,000, or a 17% share of the import market. Sales prospects are favorable for U.S. exporters of the following types of capacitors:

- Fixed paper capacitors
- Fixed film capacitors

- Fixed electrolytic capacitors
- Ceramic capacitors

Demand should remain high for variable capacitors such as fixed paper and film types that are used in large quantities by both the consumer electronic products and the telecommunications equipment industries. The market for imported fixed electrolytic and ceramic capacitors also seems headed for rapid expansion. Australian requirements for these devices have been increasingly supplied by imports as some local manufacturers, considering the tariff protection for these components inadequate, closed a number of plants in the late 1960's and early 1970's.

Resistors.—Australian purchases of resistors expanded 24% during the 1971-73 period, climbing from \$8.3 million to \$10.3 million and should reach \$13 million in 1977.

Imports increased from \$2.1 million in 1971 to \$3.3 million in 1972 and are expected to approach \$6 million in 1977. Imports from the United States in 1972 amounted to \$438,000, or 16% of the \$2.6-million import market.

Due primarily to the development of integrated and printed circuit techniques that have had wide acceptance in Australia, thin film resistors have replaced the conventional carbon composition devices as the most popular type of resistor. The sizable market anticipated for color television receivers, which require more than 250 resistors per unit as opposed to about 120 in monochrome sets, should generate increased sales of these as well as of other electronic components. The demand for high-quality resistors, including the fixed film types that are mostly imported, should remain strong for the next 5 or 10 years. After that, technological advances will decrease requirements for these passive components.

Integrated circuits.—The Australian market for integrated circuits is expected to increase at an average annual rate of about 25% during the 1973-77 period, climbing from \$7.5 million to over \$19 million. The 1973 level of the market represents a 75% rise over the 1971 figure of \$4.3 million.

Imports of integrated circuits in 1973 amounted to \$3.9 million, or about 52% of the market. The import market in 1977 is projected to exceed \$10 million, reflecting an average annual growth rate of approximately 26% from the 1973 level.

Purchases of U.S.-made integrated circuits in 1972 totaled close to \$1.3 million, a 43% share of the import market. Imports of digital integrated circuits, the most popular type of solid state component in Australia, amounted to \$858,000 in 1972; U.S. suppliers accounted for two-thirds of these sales. The forecast for future sales of U.S.-origin integrated circuits, considered to be the most

Australia—The Electronics Industry Basic Data (FY 1971)

Total value of production:	\$730 million
Number of manufacturers:	246
Industry labor force:	35,692
Output of principal electronic components user industries—	
Consumer products industries:	
radio and television sets	\$83.7 million
record players	\$11.7 million
Industrial/commercial equipment industries:	
computers and related equipment	\$99 million
communication equipment	\$409 million
measuring and testing instruments	\$3-\$8 million
industrial equipment	\$66 million

technologically advanced available, is highly optimistic.

Integrated circuits are being used in Australia in a widening variety of applications, including radio and line communications equipment, consumer products, automotive electronics systems, and industrial control and defense equipment. Furthermore, as these devices decline in cost, they are expected to displace many of the discrete semiconductors currently used in Australia.

While the market for all types of integrated circuits is forecast to expand sharply over the next 5 years, sales of digital hybrid integrated circuits probably will show the fastest rate of growth. Hybrids will be used more and more in automotive fuel injection, electronic ignition, and safety systems. They also will be an integral part of future automotive diagnostic systems that will convey malfunctions to the driver via dashboard readout.

Diodes and rectifiers.—The market for diodes and rectifiers, which increased moderately from \$7.1 million in 1971 to \$8.7 million in 1973, is expected to expand at an average annual rate of over 10% a year, reaching almost \$13 million in 1977.

Imports amounted to \$3.1 million in 1971, satisfying 35% of total demand, and should approach \$5 million in 1977. The U.S. share of the import market rose appreciably from 45% (\$1.2 million) in 1971 to 56% (\$1.6 million) in 1972. Among the most highly salable devices in this segment of the Australian market are the following:

- Silicon diodes
- Zener diodes
- Silicon rectifiers

The new market for color TV sets should ac-

Table 1.—Australia: Size of market¹ for selected groups of electronic components, 1969-77
(in millions of U.S. dollars)

Description	1969	1971	1972	1973	1974	1977
<i>Resistors</i>						
Production ²	6.1	6.3	6.7	7.3	7.7	7.6
Imports	1.7	2.1	2.6	3.3	4.2	5.8
Exports .....	.2	.1	.2	.3	.3	.4
Market size	7.6	8.3	9.1	10.3	11.6	13.0
<i>Capacitors</i>						
Production ²	5.2	6.0	8.6	8.9	9.1	8.8
Imports	3.6	5.6	5.0	5.7	7.0	7.6
Exports .....	.6	.4	.3	.4	.6	.8
Market size	8.2	11.2	13.3	14.2	15.5	15.6
<i>Color TV picture tubes³</i>						
Production ²	—	—	—	—	—	—
Imports	—	—	—	—	5.9	44.1
Exports	—	—	—	—	—	—
Market size	—	—	—	—	5.9	44.1
<i>Diodes and rectifiers</i>						
Production ²	3.3	4.8	5.5	6.4	7.3	9.4
Imports	2.8	2.6	2.8	3.1	3.5	4.7
Exports .....	.1	.3	.5	.8	1.1	1.2
Market size	6.0	7.1	7.8	8.7	9.7	12.9
<i>Transistors</i>						
Production ²	7.7	12.4	12.8	13.6	13.7	16.3
Imports	3.0	3.2	5.2	5.7	7.2	10.6
Exports .....	.9	1.0	.8	.9	.9	1.0
Market size	9.8	14.6	17.2	18.4	20.0	25.9
<i>Integrated circuits</i>						
Production ² .....	.7	2.5	3.4	3.7	4.3	9.1
Imports	1.4	1.8	2.9	3.9	4.9	10.2
Exports	—	—	.1	.1	.1	.1
Market size	2.1	4.3	6.2	7.5	9.1	19.2
<i>Totals</i>						
Production ²	23.0	32.0	37.0	39.9	42.1	51.2
Imports	12.5	15.3	18.5	21.7	32.7	83.0
Exports	1.8	1.8	1.9	2.5	3.0	3.5
Market size	33.7	45.5	53.6	59.1	71.8	130.7

¹ Size of market equals production plus imports minus exports. Parts and accessories not included.

² Production figures for 1969-73 include components manufactured by OEM's for their own use. In-house production of diodes and rectifiers represents about 20% of the total; transistors, 30%; and integrated circuits, 40%.

³ Inauguration of color television broadcasting is planned for March 1975.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

centuate demand for silicon diodes and zener diodes, both of which are used extensively in TV set production. Modernization and expansion of the Australian telecommunications system will create a strong demand for silicon rectifiers for use in electronic switching equipment. Rapidly expanding use of silicon rectifiers in automotive applications is sparking yearly increases in purchases of these devices by automakers.

Other electronic components.—Components outside the product category having high sales potential in Australia include the following:

Connectors.—Purchases of connectors in 1972 totaled \$17.9 million. Demand for most types of connectors is largely met by local suppliers. However, the expected rise in Australian production of

automotive electronic systems should result in a good market for imported circular connectors, which domestic manufacturers are not in a good position to supply.

Inductors.—The market for inductors increased over 20% between 1972 and 1973, climbing from \$9.1 million to \$11 million. Despite the multiplicity of transformers needed to meet varying cost and user requirements, about 80% of sales are from standard lines. Trade sources feel that American producers of transformers could open up new markets provided they offer Australian users applications assistance and product tailoring.

Relays and switches.—Sales of relays and switches totaled \$6.7 million in 1972. Overseas suppliers should find their best sales prospects in standard

types of switches, particularly slide switches for television production. The market for switches in 1972 reached approximately \$1.02 million, or 720,000 units, and is expected to increase to \$1.15 million by 1975.

Quartz crystals.—The 1972 market for quartz crystals and crystal filters amounted to \$2 million (292,000 units) and \$358,000 (20,000 units), respectively. Manufacturers of mobile transceivers are, and are expected to remain, Australia's principal users of quartz crystals. An entirely new market for these devices will open with the start up of local color TV set production. Demand will be strongest for crystals operating at about 4.43 MHz. As it is considered unlikely that these devices will be produced locally, a sizable market should emerge.

Thyristors.—The Australian market for thyristors amounted to \$1.7 million in 1972. If domestic television manufacturers follow the European pattern of using thyristors for horizontal deflection circuitry in both color and black-and-white receivers, demand could rise appreciably as color TV set production increases. Approximately \$1 million worth of silicon controlled rectifiers were imported in 1972. The domestic color TV set industry, which is just now developing, is expected to spur strong demand for imported thyristors in the years immediately ahead.

Special semiconductor devices.—Australia's expenditures for LED's and photoelectric and thermionic devices totaled \$1.1 million in 1972, and prospects for future growth appear favorable. Increased demand for electronic industrial control equipment that utilizes LED's for warning lights and numerical displays should result in a growing market. Expanding requirements also are predicted for thermionic devices, which are being used increasingly in both the consumer products and industrial equipment sectors.

Selected End-User Industries

The Australian consumer products sector, with

a sales volume of \$173 million in 1971, is the largest user of electronic components, accounting for 65 to 75% of the market. The industrial/commercial and military equipment sectors, with aggregate sales of \$470 million in 1971, account for 20 to 30% of the country's total annual component purchases. Although the industrial/commercial equipment sector's demand for components is small relative to its sales volume, it uses a large proportion of sophisticated devices. The military equipment sector in Australia represents a much smaller market for electronic components than both the consumer products and industrial/commercial equipment sectors. The bulk of components consumed by the military equipment sector is purchased abroad because local producers are not in a position to meet their special requirements. It should be noted that the major producers of military equipment are also the major manufacturers of industrial/commercial equipment.

Consumer products sector.—Australia's 45 establishments engaged in the production of radios, record players, and televisions employed 10,724 people in 1971. Of the sector's total output of \$128.4 million during FY 1972, \$74.9 million represented production of monochrome television receivers; \$41.8 million, radios; and \$11.7 million, record players.

The boom in sales of consumer electronic products during the 1971-73 period is likely to be sustained over the next several years. Australian retail sales have been rising since 1969 at a seasonably adjusted rate of 12%; installment credit, at 5%. The growth in disposable income and the ready availability of credit have had a salutary effect on the consumer electronic products industry.

Television industry.—The television receiver manufacturing industry, with some 4,500 employees and capital investments in excess of \$50 million, is the largest industry within the consumer products sector in Australia. Production of black-and-white

Table 2.—Australia: Imports from the United States, and share (by value) of total imports, of selected groups of electronic components, 1969-72

(quantity in thousands of units; value in thousands of U.S. dollars)

Description	1969			1971			1972		
	Quantity	Value	U.S. share (percent)	Quantity	Value	U.S. share (percent)	Quantity	Value	U.S. share (percent)
Resistors	338	546	31	529	557	25	470	438	16
Capacitors	1,183	776	21	2,319	1,071	19	1,562	884	17
Color TV picture tubes ¹	—	—	—	—	—	—	—	—	—
Diodes and rectifiers	702	852	30	1,621	1,177	45	859	1,553	56
Transistors	1,087	2,041	67	1,393	1,910	60	2,848	1,554	29
Integrated circuits	373	1,107	80	459	1,362	75	608	1,271	43
Total	3,683	5,322	42	6,321	6,077	39	6,347	5,700	30

¹ Inauguration of color television broadcasting is planned for March 1975. Currently there is no production of color TV sets or tubes in Australia.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

receivers reached 354,000 units in 1972 and 383,000 in 1973. Demand for monochrome TV receivers is forecast to decline to 340,000 units in 1974 and to 200,000 in 1977, following the inauguration of color television broadcasting, which is planned for March 1975. Purchases of color televisions, based on a price range of \$800 to \$1,000 per set, are projected to climb from 20,000 units in 1974 to 360,000 in 1977. The color TV market should be in the \$320-million to \$400-million range in 1977.

Manufacturers of monochrome television receivers in Australia, whose products generally evidence a high level of sophistication, utilized about \$45 million worth of electronic components in 1973. The television industry is expected by 1977 to represent a \$144 million annual market for electronic components and parts. Color television receiver manufacturing is expected to account for \$114 million of this total consumption figure and monochrome set manufacturing for \$30 million.

The Australian Broadcasting Control Board has adopted the PAL system for color TV telecasting. PAL is similar to the system used in Britain and most of Europe but differs from the NTSC system employed in the United States and Japan. Both use the same types of picture tubes and many of the same components; the main difference between them is in the details of circuitry.

Australia's leading television receiver producers have pursued a policy of either vertical or horizontal expansion. Amalgamated Wireless (Australasia), Ltd. (AWA), headquartered in Sydney, and Philips Telecommunications Manufacturing Company Limited in Clayton, Victoria, are the two most integrated companies in the electronics industry and have the most diversified line of products. These two companies, together with Pye Industries, Pty., Ltd. in Marrickville, N.S.W., account for 70% of the Australian television receiver market.

The AWA group, the only major Australian-owned company manufacturing TV sets, merged with Thorn Industries in July 1973. The AWA-Thorn group currently commands an estimated 30 to 35% share of the television set market.

Philips has also maintained an active policy of integration and expansion in recent years. It took over Kriesler and Astor, two leaders in television receiver production, in 1967, and in 1969 the company opened a large semiconductor factory in South Australia. AWA, similarly, has augmented semiconductor production in response to increased local demand. Trade sources report, however, that the trend toward vertical integration may not continue for long due to the many problems associated with components manufacture and the technological capability of foreign manufacturers to develop new and more advanced components at competitive prices.

Other important manufacturers of television receivers in the country are EMI Electronics (Australia) in Elizabeth, South Australia, and Matsushita Electric Co. Australia Pty., Ltd., in Clayton, Victoria. EMI is a subsidiary of a British company but has 35% local equity. General Electric is the only U.S. subsidiary manufacturing TV receivers in Australia and holds about a 10% share of the domestic market.

The anticipated expansion of the Australian television receiver market is likely to induce some foreign TV set manufacturers to establish production facilities in Australia in the near future. The Japanese company, Sanyo Electric Co., for example, recently set up a 50-50 joint venture with Guthrie Australia Pty., Ltd., to produce color television sets for the Australian market. Construction of a new plant in Wodonga, near Melbourne, is underway. Plans call for the production of 20-inch and 26-inch (PAL type) color televisions at the rate of about 2,000 per month.

Industrial/commercial equipment sector.—The industrial/commercial equipment sector accounts for 20 to 30% of Australia's annual consumption of components. The buying pattern in this sector is marked by large outlays for the more advanced type of components, such as power transistors for electronic ignition systems and hybrid integrated circuits for telephone switching equipment. This trend is expected to continue. The major subsectors within the industrial/commercial equipment sector are the telecommunications, measuring and testing instruments, medical electronic equipment, industrial equipment, and data transmission equipment industries.

Telecommunications industry.—The telecommunications industry comprises some 45 firms, with about 20,000 employees and assets totaling over \$325 million. The industry's sales volume in 1971 was placed at \$409 million, representing approximately 56% of the total sales of the electronic industry.

The telecommunications industry is by far the largest user of product category components in the industrial/commercial equipment sector. Underlying the industry's expanding demand for electronic components is the continuing high level of expenditures for telecommunications by the Australian Post Office (APO).

Prior to 1939, the APO purchased less than 30% of its telecommunications equipment requirements from Australian sources. Beginning in the late 1940's, a policy of buying locally-made products whenever possible led to the rapid expansion of domestic output to the point where about 85% of the APO's needs are now met by domestic manufacturers.

Major undertakings during the past 10 years have included the installation of large-capacity multipurpose trunk systems that have made possible instant

STD trunk calls, nationwide television relays, facsimile transmission of whole newspapers, and a wide range of other transmission facilities. Installation of the first electronic exchange in Australia is now nearing completion. This and three other electronic exchanges ordered by the APO, involving contracts totaling \$20 million, are intended for trunk traffic operations. Depending upon the policies of the APO, electronic switching is expected to supplant present outdated methods in major local exchanges within 5 to 15 years.

APO purchases of telecommunications equipment and cable in 1972 amounted to \$256 million, or more than 50% of the industry's total sales for that year. Included in the APO's expenditures were \$75 million for telephone switching equipment, \$45 million for long line equipment, \$7 million for radio equipment, \$62 million for cable, and \$67 million for other related equipment.

The three major Australian-owned telecommunications equipment firms are Amalgamated Wireless (Australasia), Ltd. (AWA), Austral Standard Cables (ASC), and Centre Industries. AWA produces a broad range of equipment and is a major supplier to the military sector. ASC fabricates single-pair subscriber cable, VF and HF cable for interconnecting exchanges, multipair wire cable, and coaxial cable for trunk routes. Centre Industries is an important supplier of crossbar switching equipment.

The industry also includes several wholly owned subsidiaries of overseas corporations. Standard Telephone and Cables Pty., Ltd. (STC), a subsidiary of ITT with over 4,000 employees, has been one of Australia's largest suppliers of telegraph and data communications equipment for more than 20 years. The firm produces 30 to 35% of the crossbar-type, main exchange switching equipment used in the country. In addition, STC fabricates private automatic branch exchanges (PABX) that are connected to the public network, private automatic exchanges (PAX), private automatic loudspeaking exchanges (PALX), and handset intercommunications of various kinds. STC, as the former world research center in the Pentaconta PABX field for its parent company, is responsible for the introduction of many large and complex systems in Australia. The APO uses STC mobile radio telecommunications, an important form of communications in Australia, in all states. There are approximately 130,000 mobiles currently in use throughout the country.

Other U.S. subsidiaries producing telecommunications equipment in Australia include Collins Radio Co. (A'asia) Pty., Ltd., headquartered in Melbourne, and Hewlett-Packard Australia Pty., Ltd., in Melbourne and Sydney. Hewlett-Packard produces two-way radio telephone equipment, radio communication systems, microphones, regulated power supplies, and engineered electronic assemblies. Page Commu-

nications Engineers Pty., Ltd., in North Sydney, N.S.W., manufactures telecommunications and information systems.

Industrial equipment industry.—This industry had sales of \$66 million and assets of \$46 million in 1971. It employs more than 3,500 people. Among the more promising sales prospects for electronic components in this segment of the market are the automobile manufacturers. Although present usage by automakers of controls affecting the performance, safety, and convenience features of cars is modest, government requirements for car safety and environmental control are expected to spur rapid development of the automotive electronics market. A sharp rise in demand is foreseen during the 1970's for advanced components by the automotive industry.

The Competitive Environment

Australian production of the electronic components under review totaled \$39.9 million in 1973 and is projected to increase at an average annual rate of 6.5%, reaching over \$50 million in 1977. Most of Australia's 66 manufacturers have specialized to meet the needs of domestic electronics firms.

Exports of electronic components amounted to only \$2.5 million in 1973. Due to the small size of the Australian market and the relatively high cost of labor in Australia, compared to nearby Asian countries, exports of electronic components are not expected to increase significantly in the next few years.

The two leading Australian-owned producers of components are I.R.H. Industries, Ltd. (IRH), of Kingsgrove, N.S.W., and Amalgamated Wireless (Australasia), Ltd. (AWA). AWA manufactures a wide range of components, both for in-house use and for the open market. These include integrated circuits, television picture tubes, transistors, receiving tubes, switches, inductors, and capacitors. IRH is a leading manufacturer of resistors.

The Australian electronic components industry is characterized by a high degree of foreign participation. Fairchild Australia Pty., Ltd., in Croydon, Victoria, and Standard Telephone and Cables Pty., Ltd. (STC), two U.S. subsidiaries, are considered the most advanced producers of semiconductors in Australia. Most of Fairchild's output consists of silicon transistors. The company is also focusing more and more on the manufacture of integrated circuits. STC is Australia's most important manufacturer of thyristors. It also produces power rectifiers and transistors, many of them designed for industrial applications. N.S. Electronics Pty., Ltd., in Victoria, a subsidiary of National Semiconductor Corporation of the United States, manufactures a wide range of semiconductor devices and imports a large number from its parent firm as well.

The Philips subsidiary, Philips Industries (Elcoma) Pty., Ltd., is possibly the largest manufacturer of semiconductors in Australia. Its output, which also includes capacitors, is essentially geared to the consumer products sector. The leading producers of capacitors, Plessey Ducon Pty. Ltd., a British subsidiary, and A.E.E. Capacitors, a subsidiary of L. M. Ericsson, of Sweden, face strong competition from Japanese firms. As a result, some capacitor production has been curtailed in recent years, and further cutbacks remain a possibility.

A large domestic market for connectors in Australia has led to an influx of foreign manufacturing subsidiaries. Australian AMP Pty., Ltd., a subsidiary of the U.S. firm AMP Incorporated; McMurdo, a British subsidiary; and the Cannon Company, an ITT subsidiary, are the leading foreign-owned connector manufacturers. The only important Australian-owned company in the field is Utilux Pty., Ltd.

Government policy changing.—The Australian Government in December 1973 announced a major shift in its policies toward the domestic electronic components industry. Local production of electronic components and finished electronic products, had been protected for several decades by a high tariff structure. However, the Government recently accepted the basic thrust of the Tariff Board Report on Consumer Electronic Equipment which recommended that existing duty rates be reduced. Instead of encouraging Australian industry by means of tariff protection, the Government intends to directly subsidize manufacturers of those types of electronic components considered essential to the defense, the telecommunications system, or the technological advancement of the country.

Another incentive to the expansion of the domestic electronic components industry is the Federal Government's "offsets" program which requires foreign suppliers to submit proposals for Australian industrial participation in all major purchases from foreign sources. In addition, a variety of inducements are offered by state governments. Low interest loans, inexpensive industrial land, and freight concessions have been offered to companies willing to locate in certain states. The South Australian Government, in particular, has been active in encouraging growth of the electronics industry by generous support. The effect of the recent tariff cuts will be watched closely by the governments of those states in which electronic components production has been concentrated, and assistance will be provided to firms and employees harmed by the changes in duty rates.

Outlook for U.S. excellent.—Determined efforts by U.S. firms should increase their share of the growing Australian electronic components market, which has yet to be fully exploited by American producers.

Trade sources suggest that U.S. exporters could further their penetration of the Australian electronic components market by providing more applications assistance to electronic end-product manufacturers. The country's producers of consumer electronic products would be especially receptive to additional information about the cost saving benefits of various components.

American companies active in the Australian electronic components market include AMP, Inc.; Alltronics, Inc.; Components Incorporated; Infoton, Inc.; Iomec; Raytheon Co., Rolm Corporation, and Signetics.

Major foreign competition comes from the Japanese companies, A&R Soaner Group; Elna Electronics; Hakuto Co., Ltd.; and Hitachi, Ltd. Suppliers from the United Kingdom include Alston Capacitors, Ltd.; BIM; Dawe Instruments; International Electronics, Ltd.; and Marconi Microelectronics. The Canadian company, Sangamo Co., Ltd., has also made successful inroads in the Australian market.

Duty rates cut.—In addition to an across-the-board reduction of 25% in duty rates as of July 1973, the Australian Government announced in November 1973 a policy of lowering the applicable tariffs on electronic components. The new rates of duty, subject to international commitments, are 35% on most components. Information on official duty rates applicable to specific products within the product category may be obtained from the U.S. Department of Commerce, Domestic and International Business Administration, Room 4217, Main Commerce, Washington, D.C. 20230.

Technical Requirements

The electrical power supply characteristics in Australia are 240 volts, 50 hertz.

The English system of weights and measures is the statutory standard in Australia. However, the metric system is also widely used, and the Metric Conversion Act, passed in 1970, aims at the replacement of the English system over a 10-year period.

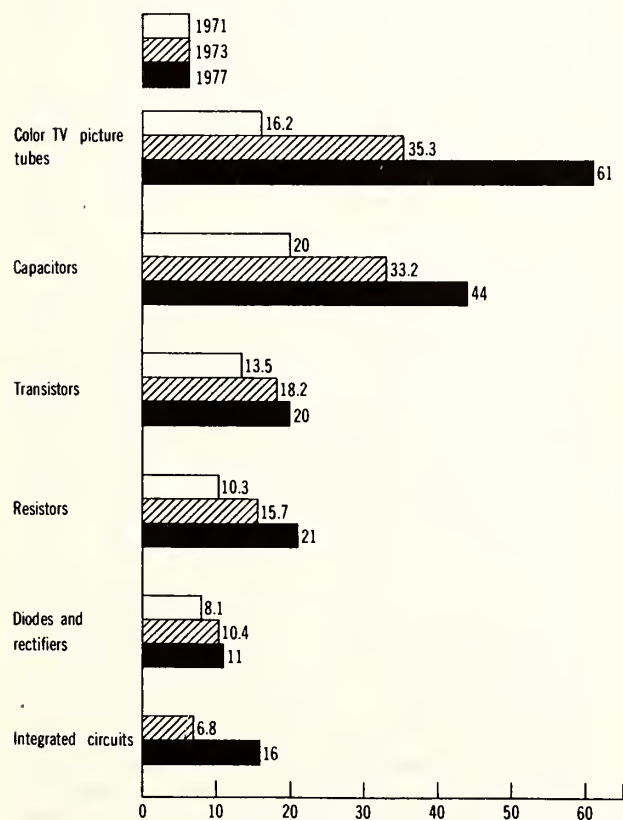
Published national standards for electronic components in Australia may be obtained through the American National Standards Institute, Inc., 1430 Broadway, New York, N.Y. 10018.

The following market research study, upon which this Country Market Survey is based, is available on loan from the U.S. Department of Commerce, Domestic and International Business Administration, Room 1617M, Main Commerce, Washington, D.C. 20230: "The Market for Electronic Components in Australia," DIB 74-02-510, November 1973.

Belgium

The total Belgian market for electronic components is expected to grow at an average annual rate of nearly 8% during the 1973-77 period, a pace which should boost annual consumption from \$195 million to \$260 million. Demand will stem from the sharp growth in Belgium's electronics industry output, which is forecast to rise from \$685 million in 1972 to \$1.6 billion in 1977.

Belgium: Size of market for selected groups of electronic components, 1971-77
(in millions of U.S. dollars)



Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

Belgium's aggregate purchases of the selected groups of electronic components covered in this survey increased more than 75% between 1971 and 1973, climbing from \$68 million to \$120 million (see table 1). The market is expected to continue its rapid rise, approaching \$175 million in 1977.

Belgium depends largely on imports to satisfy its growing needs for electronic components since the bulk of domestic production is exported. Imports in 1971 were valued at \$62.6 million, accounting for 92% of total Belgian consumption of product category components. This proportion leveled off at 87%, or just under \$104 million, in 1973. Imports are projected to supply slightly over 80%, or about \$143 million, of the market in 1977.

American-designed products account for an important share of the Belgian import market for electronic components. However, because of the high level of Belgium's imports of components from overseas-based manufacturing subsidiaries of U.S. firms, imports from the United States accounted for only 5% (\$3 million) of the country's import market for product category components in 1971 and 9% (\$6.5 million) in 1972 (see table 2). The preference of Belgian users for advanced U.S.-origin components, evidenced by the 67% U.S. import

Product Category Definition

Electronic components covered in this survey are basically confined to resistors, capacitors, color TV picture tubes, diodes and rectifiers, transistors, and integrated circuits.

The term "product category" as used in this publication is limited to these six groups of components.

**Belgium—Selected Indicators
(1972)**

Gross national product:	\$35.6 billion
Population:	9,727,000
Total country imports:	\$14,770 million
Imports from U.S. (w/share of total):	\$810 million (5.5%)
Total country exports:	\$15,284 million
Exports to U.S. (w/share of total):	\$914 million (6.0%)
Exchange rate (May 1974):	37.74 Belgian francs =US\$1

market share for IC's in 1972, should be reflected in increased sales for American suppliers. Imports from the United States are conservatively projected to exceed \$15 million in 1977, an increase of \$8.5 million over the 1972 level.

The Netherlands is the leading foreign supplier of product category components to Belgium, followed by Germany.

Sales Opportunities

A market research survey recently conducted in Belgium for the U.S. Department of Commerce, Office of International Marketing reveals that favorable sales opportunities exist for American exporters of the following electronic components:

Capacitors.—The market for capacitors in Belgium increased 66% between 1971 and 1973, rising from \$20 million to over \$33.2 million. The market is predicted to grow an average of 7.5% a year, reaching over \$44 million in 1977.

Imports increased 87% during 1971-73, rising from \$18.1 million to \$33.9 million. The 1977 import market is forecast at more than \$50 million, a nearly 50% increase over the 1973 level. The U.S. share of the 1972 import market was 4%, valued at \$900,000.

Electrolytic, film, and ceramic capacitors have a particularly good sales potential. A steady growth in the market for chip capacitors is expected to accompany the more widespread use of hybrid IC's. The demand for nonelectrolytic capacitors used for coupling, for timing, and in filter circuits, will fall over the next few years as a result of increasing integration of these functions.

Transistors.—Purchases of transistors grew 35% from 1971 to 1973, increasing in value from \$13.5 million to \$18.2 million. The market is expected to reach \$20 million in 1977.

Belgian imports of transistors rose to \$15.8 million in 1973, an increase of 31% over the 1971 figure of \$12.1 million. Moderate growth is ex-

pected to bring the 1977 import total to approximately \$17 million. Purchases of transistors from the United States in 1972 accounted for \$1.7 million, or 14% of the \$12.6-million import market.

Silicon n.p.n. power transistors have an especially favorable sales outlook, due primarily to increasing demand by manufacturers of TV receivers and audio equipment. Trade sources forecast a leveling off of demand for small-signal transistors.

Resistors.—Belgian consumption of resistors increased more than 50% from 1971 to 1973, growing from \$10.3 million to \$15.7 million. Annual purchases are expected to approach \$21 million in 1977.

Imports also increased almost 50%—from \$9.9 million to nearly \$14.6 million during the 1971-73 period. A \$17-million import market is predicted for 1977. The U.S. share of 1972 imports of resistors was 7%, valued at \$800,000.

Variable and thickfilm resistors have excellent sales prospects. Belgian manufacturers continue to find new applications for variable resistors, and demand for them is rising. There also is a growing trend toward the use of thickfilm power resistors in a wide range of consumer products.

Diodes and rectifiers.—Expenditures for diodes and rectifiers expanded from \$8.8 million in 1971 to \$10.4 million in 1973, representing an average annual increase of over 13%. The market is projected to exceed \$11 million in 1977.

Imports grew from \$7.1 million in 1971 to \$8.5 million in 1973. The import market is expected to dip to about \$8 million in 1977. Purchases from the United States in 1972 amounted to \$700,000, a 9% share of the import market.

The market for diodes and rectifiers is leveling off, but the demand for power diodes in the TV industry should remain steady.

Integrated circuits.—Demand for integrated circuits is just beginning to accelerate in Belgium. Sales of IC's are expected to have the highest growth rate of any single group of components within the product category. Trade sources envision an average annual growth of nearly 35% in the market for IC's, with sales climbing from \$6.8 million in 1973 to approximately \$16 million in 1977.

Imports are predicted to increase an average of almost 25% yearly, rising from \$4.7 million in 1973 to \$11 million in 1977. The United States was the leading foreign supplier of IC's in 1972, holding a 67% import market share, valued at \$2 million.

Belgian computer manufacturers are replacing ferrite core memories with semiconductor memories in their computers. The 1103 IC is used primarily. The market for this type of IC is supplied completely by imports, particularly from the United States and Canada. Manufacturers also are beginning to use PROM and 1024 RAM bipolar sub-

assemblies in peripheral equipment. Bipolar memories also are being used more frequently in industrial instruments.

Steady demand through 1977 is expected for standard TTL for use in the production of CPU's and for slow speed pulse code modulation (PCM) systems. Demand is also developing for lower power TTL for use in telecommunications test equipment.

Microprocessors and distributed storage are being used more widely in peripherals and terminals. Implementation of these microprocessor systems requires a single chip parallel processor used in conjunction with RAM's and ROM's. There are growing requirements for MOS microprocessor chip sets in control instruments.

Belgian manufacturers are beginning to incorporate bipolar saturated logic and MOS logic integrated circuits in their industrial instrumentation and telecommunications equipment. CMOS is being substituted for TTL in a number of industrial controls and instruments. Bipolar saturated logic is used for electronically controlled reed relay exchanges and MOS storage registers for push-button telephone equipment. MOS "bucket brigade" analog serial memories are used in pulse compression applications.

Interface circuits (line drivers/receivers), D/A and A/D convertors, and operational amplifiers are being used more extensively in industrial controls and instruments. Operational amplifiers are also needed for handsets in the telecommunications industry and for aerospace and military communications equipment.

Phase-lock loop IC's are used increasingly in industrial controls and for tone decoders in telecommunications.

Strong competition in the consumer electronic equipment sector is inducing manufacturers to use a larger number of IC's to produce more sophisticated products with potentially greater market appeal. IC's are being used in the production of color TV receivers and audio equipment for IF amplification and automatic frequency controls for tuners. The typical TV set produced in Belgium incorporates about six IC's, although there are 12 IC's in some 1974 models. The number will be reduced as higher density circuits are developed.

Other electronic components.—Components outside the product category considered as having good U.S. export potential include thyristors and light emitting diodes. Thyristors are in demand for a wide range of applications in industrial equipment and for TV receivers, domestic appliances, and light dimmers (bidirectional Triacs). The market for thyristors in 1972 was \$1.5 million. Light emitting diodes have promising prospects for sales, especially to manufacturers of telecommunications equipment.

Belgium—The Electronics Industry— Basic Data (1972)

Total value of production:	\$800 million (est.)
Industry labor force:	70,000 (est.)
Output of principal electronic component user industries—	
Consumer products industries:	
radio and audio equip.	\$154 million
television sets	\$109 million
domestic appliances	\$39 million
Industrial/commercial equipment industries:	
telecommunications equipment	\$169 million
computers and related equipment	\$126 million
measuring and test instruments	\$54 million
industrial equipment	\$41 million

Selected End-User Industries

The total value of production by Belgium's electronic end-products industry in 1972 was an estimated \$686 million. Conservative forecasts place the 1977 output in excess of \$1.6 billion. The industry's strength lies in the production of radios and audio equipment, telecommunications equipment, EDP equipment, and TV sets (see table 3).

The industrial/commercial equipment sector is the largest user of electronic components in Belgium, accounting for more than 60% (about \$122 million) of the country's total purchases in 1973. The consumer products sector accounted for 25% (almost \$50 million) of total components purchases in that year. The military equipment sector accounted for 12.5% of total 1973 component purchases, or about \$24 million. These relative sector shares of the component market are expected to remain about the same through 1977.

Industrial/commercial equipment sector.—The 1972 value of Belgian production of telecommunications equipment, EDP equipment, measuring and testing instruments, medical equipment, other electronic industrial equipment, and electronic calculators totaled \$379 million. Output of these products is forecast to rise at an average annual rate of more than 20% during the 1972-77 period, bringing the total to well over \$1 billion in the later year. The sector employs approximately 50,000 workers.

Telecommunications equipment.—The telecommunications equipment industry, the largest in the sector, registered an output of \$153 million in 1972. Production in 1973 rose to \$238 million, a 55%

Table 1.—Belgium: Size of market¹ for selected groups of electronic components, 1971-77
(in millions of U.S. dollars)

Description	1971	1972	1973	1974	1977
<i>Resistors</i>					
Production	13.4	20.4	29.3	36.7	46.1
Imports	9.9	10.8	14.6	15.7	17.0
Exports	13.0	19.9	28.2	35.3	42.4
Market size	10.3	11.3	15.7	17.1	20.7
<i>Capacitors</i>					
Production ²	11.2	13.6	18.4	19.6	21.5
Imports	18.1	22.3	33.9	39.5	50.4
Exports	9.3	11.7	19.1	22.6	27.7
Market size	20.0	24.2	33.2	36.5	44.2
<i>Color TV picture tubes</i>					
Production ²	11.2	25.0	42.4	52.5	77.9
Imports	15.4	20.5	26.8	29.4	39.5
Exports	10.4	22.8	33.9	39.5	56.5
Market size	16.2	22.7	35.3	42.4	60.9
<i>Diodes and rectifiers</i>					
Production	1.6	1.7	2.3	2.6	4.0
Imports	7.1	6.9	8.5	8.3	7.9
Exports .....	.6	.3	.4	.5	.6
Market size	8.1	8.3	10.4	10.4	11.3
<i>Transistors</i>					
Production	2.2	3.4	4.9	5.3	7.0
Imports	12.1	12.6	15.8	16.1	16.7
Exports .....	.8	1.8	2.5	2.8	3.7
Market size	13.5	14.2	18.2	18.6	20.0
<i>Integrated circuits</i>					
Production	—	2.3	3.5	4.3	7.6
Imports	—	3.0	4.7	5.6	11.0
Exports	—	.9	1.4	1.8	2.7
Market size	—	4.4	6.8	8.1	15.9
<i>Totals</i>					
Production	39.6	66.4	100.8	121.0	164.1
Imports	62.6	76.1	104.3	114.6	142.5
Exports	34.1	57.4	85.5	102.5	133.6
Market size	68.1	85.1	119.6	133.1	173.0

¹ Size of market equals production plus imports minus exports. Parts and accessories not included.

² Production figures include components manufactured by OEM's for their own use. In-house production of capacitors represents 10 to 15% of the total, and color TV picture tubes, 20%.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

increase over the previous year. Output is expected to approach \$460 million by 1977.

The industry has a reputation for producing some of the most advanced telecommunications equipment in Europe. Production is now concentrated on the manufacture of semielectronic exchanges and the development of fully electronic switching.

The two largest companies in Belgium's telecommunications equipment industry are affiliated with U.S. firms. Bell Telephone Manufacturing Co. N.V., an ITT subsidiary, is responsible for 50% of the industry's output; Automatic Electric S.A. (ATEA), a GTE subsidiary, produces 20% of the total. Siemens, a German subsidiary, accounts for 15% of total production, and Manufacture Belge de Lampes et Materiel Electronique (MBLE), a subsidiary of the Dutch Philips organization, contributes another 10%. A Belgian firm, Constructions

Mecanique Electrique et Telephonique (CETEL), specializes in the production of telephone exchanges and accessory equipment and is responsible for 3% of Belgium's production of telecommunications equipment.

Bell Telephone N.V., which has nine plants employing approximately 15,500 people, devotes a large part of its resources to research and development. In the past few years, it has developed two products that have been marketed successfully—the Metaconta 10C switching system and the PCM 32 carrier system.

The Metaconta 10C electronic switching system is used extensively in Belgium and is exported to 80 other countries. The system uses reed relay, computer controlled technology. Its modular structure provides a high degree of standardization and simplifies the installation of extension lines. The sys-

tem features high speed selection and "absent subscriber" and call transfer facilities. The PCM 32 carrier allows the transmission of 30 conversations simultaneously.

ATEA, employing some 3,000 persons, specializes in the development and production of automatic telephone equipment. The company recently opened a new plant in Herentals. In 1969, it produced the first electronic telephone exchange built in Belgium. ATEA's current product line includes automatic private exchanges of various sizes which can be connected to the public exchange system, as well as different types of signalling, activating, and controlling equipment for telephone exchanges.

Bell Telephone N.V. manufactures some of its own components, including reed relays, larger relays, and capacitors, and also obtains some components from its parent company, ITT. The company purchases some passive components and a large proportion of its IC requirements from outside sources.

ATEA also manufactures standard components such as relays, connectors, and inductors but looks to outside sources for the more sophisticated devices. Siemens and MBLE give preference to components produced by their parent companies. However, component suppliers who can offer competitive prices, applications assistance, and satisfactory back-up service have good opportunities to become primary or secondary sources of supply to manufacturers throughout the Belgian telecommunications equipment industry.

Computers and related equipment.—The total Belgian output of EDP and related equipment in 1972 amounted to \$126 million. An anticipated 24% average yearly growth rate should boost production to over \$370 million in 1977.

Subsidiaries of U.S. firms manufacturing computers and/or related equipment in Belgium are Compagnie Belge S.A. (a Burroughs subsidiary), Ateliers de Constructions Electriques de Charleroi S.A.—ACEC (Westinghouse), Bell Telephone

Manufacturing Co. N.V. (ITT), and Tracerlab S.A. (International Chemical and Nuclear Corp.). Other manufacturing subsidiaries of foreign companies include Siemens S.A., and Societe Anonyme Internationale de Telegraphic Electronics (SAIT), an affiliate of CII of France.

Compagnie Belge S.A. is the largest producer of EDP equipment in Belgium. It exports between 80 and 90% of its output. The company's products include the 3700 and 1700 computer models with semiconductor memories and the 4700 model, which has a magnetic core memory. The IC memories are the 1103 p-channel MOS type. The company is expected to introduce a 4K n-channel dynamic memory into its computers by 1977. It also plans to introduce microprocessors and ROM's in its peripheral equipment in the near future.

Instruments.—Output of measuring and test instruments in 1972 amounted to \$54 million. Production is expected to increase an average of more than 15% yearly, reaching \$110 million in 1977. The major companies producing these instruments are MBLE, ACEC, ATEA, SAIT, Macq Electronique, and Cobar Electronic. Bell Telephone, Tracerlab, and Ampex S.A., a subsidiary of the U.S. Ampex Corp., also manufacture measuring and test instruments.

Siemens and ACEC are the largest companies producing medical electronic instruments in Belgium. Smaller firms active in the field include: the GE subsidiary, General Electric Medical S.A.; J. De Vree & Co. N.V., a subsidiary of the Dutch Organon Teknik; and De Man Radiologie N.V., a subsidiary of the French company CGR.

Other industrial electronic equipment.—Production of other industrial electronic equipment in Belgium includes automation and process controls, traffic signalling equipment, and electronic heating and welding equipment. Output totaled \$41 million in 1972. Production is expected to increase at an average annual rate of over 15%, reaching nearly \$85 million in 1977.

Table 2.—Belgium: Imports from the United States, and U.S. share of total imports, of selected groups of electronic components, 1971-72¹
(in millions of U.S. dollars)

Description	1971		1972	
	Value	U.S. share (percent)	Value	U.S. share (percent)
Resistors .....	.5	5	.8	7
Capacitors .....	.7	4	.9	4
Color TV picture tubes .....	.2	1	.5	2
Diodes and rectifiers .....	.5	7	.7	9
Transistors	1.1	9	1.7	14
Integrated circuits	—	—	2.0	67
Total	3.0	5	6.6	9

¹ Parts and accessories not included.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

Table 3.—Belgium: Output of selected electronic products, 1972 and projected 1977
(in millions of U.S. dollars)

	1972	1977
Radio and audio equipment	154	339
Telecommunications equipment	153	457
Computers and related equipment....	126	371
Television sets	109	144
Measuring and test instruments	54	110
Industrial equipment	41	84
Domestic appliances	39	65
Electronic calculators	5	15
Watches and clocks	5	10

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

Production of heating and welding equipment amounted to \$17 million in 1972. The major producers of this equipment are Arsenal Namurois d'Appareils de Laboratoires Industriels et Scientifiques S.A. (ANALIS), Masser S.A., and Hamel-Furet S.A.

The major firms producing general industrial electronic equipment are ACEC, Bell Telephone, SAIT, MBLE, and Siemens. Smaller companies include Macq Electronique S.A., Balteau S.A. (a GE subsidiary), ATEA, and Fabricon. Other U.S. subsidiaries manufacturing this equipment in Belgium are Ampex and Electronics Corporation of America. International Brake & Rectifier Co. S.A. (I.B.R.), a Westinghouse subsidiary, is an important manufacturer of signalling equipment.

Communications and aerospace equipment.—Production of communications equipment, including radar and navigational aids, radio communications equipment, and public broadcasting equipment, totaled \$16 million in 1972. Approximately 40% of this equipment is manufactured for use by the Belgian armed forces and other members of the NATO alliance.

Major producers of aerospace and military communications equipment are Groupement Belge des Constructeurs de Material Aerospatial (GEBECOMA), ACEC, MBLE, S.A. Belge de Constructions Aeronautiques (SABCA), Fairey S.A., F.N. Fabrique Nationale d'Armes de Guerre S.A., SAIT, Belge d'Optique et d'Instruements (OIP), and Bell Telephone. Etudes Techniques et Constructions Aeronautiques (ETCA), a joint subsidiary of ACEC and General Dynamics, specializes in the production of aerospace equipment. Cobeida, an SABCA subsidiary, manufactures avionics equipment.

Electronic calculators.—Production of electronic calculators was valued at roughly \$5 million in 1972 and is expected to reach \$15 million in 1977. Calculators are manufactured by Bell Telephone, Etap, MBLE, SAIT, Telemecanique, and Electric Belge.

Consumer products sector.—This sector's production encompasses TV receivers, radios and audio equipment, domestic appliances, and watches and clocks. Its total output reached \$307 million in 1972 and is expected to increase an average of approximately 13% yearly, approaching \$560 million in 1977. The total number of employees in this sector is about 10,000.

Radios and audio equipment.—The total value of radios and audio equipment produced in 1972 was \$154 million. Growing at a 12% average annual rate, production is expected to approach \$340 million in 1977. The major producers of radios are CARAD (a Thorn subsidiary), COBAR Electronic, Precisia Televisie, and Syma. These companies also manufacture audio equipment, along with MBLE and Constructions Electroniques.

Television receivers.—Production of TV receivers in Belgium in 1972 totaled \$109 million, with color TV sets accounting for \$49 million of this amount. The value of production is expected to reach \$144 million in 1977, an increase of 32% over 1972.

A rising standard of living in Belgium has created a high demand for color television receivers. Local production of color televisions is expected to advance nearly 33% during the 1973-77 period, rising from 340,000 sets to 450,000. Output of black-and-white receivers is predicted to decline from 260,000 sets to 100,000 during the same period.

Belgian television manufacturers supply approximately 65% of the domestic market. They also are doing well in the export market. The industry is dominated by the Philips subsidiary, CBRT, which supplies 35 to 40% of the domestic market. COBAR has a 15% market share, and CARAD has a 7% share. Precisa supplies 3% of the market.

Due to the country's geographic location, most Belgian viewers can receive at least 12 television channels broadcast from Belgium and the surrounding countries. The TV sets, however, must be able to receive both the Phase Alternating Line (PAL) transmissions, which are broadcast from Germany, Holland, and Belgium, and the Sequential à Memoire (SECAM) transmission, which is broadcast from France and Luxembourg. Most TV receivers produced in Belgium are geared to this dual specification, although the standard PAL receivers are also produced. Some cities have rediffusion facilities to transcribe SECAM transmissions for PAL receivers.

Television sets produced in Belgium are being fitted with the latest technological innovations. All receivers will soon have solid state circuitry. The 110° color tube is becoming standard for large-screen sets. TV manufacturers are equipping their sets with touch tuning and channel selection de-

vices, slider controls, and remote ultrasonic controls. MBLE has recently begun production of a decoder circuit that will allow reception of both PAL and SECAM transmission. Its cost will be comparable to that of the decoder used for PAL or SECAM single system transmission.

MBLE is manufacturing some video recording equipment. By 1977, Belgium is expected also to have substantial production of video cassette recorders.

CBRT and CARAD manufacture color TV tubes for their own use and are likely to be closed markets for outside suppliers. The Philips organization supplies most of CBRT's requirements for the other components. AEG-Telefunken supplies color tubes to many of the smaller manufacturers. GTE/Sylvania produces standard 67 cm color tubes in Belgium. Belgian manufacturers prefer the 66 cm tube, however, so most of GTE's output is exported to other European countries.

The TV set producers generally determine their source of supply of transistors, IC's, and passive components on the basis of the price of the product rather than its manufacturer.

Domestic appliances.—Production of domestic appliances in 1972 totaled \$39 million and included cookers, washing machines, and other motorized equipment. The average annual rate of growth in output of these products during the 1972-77 period should exceed 10%. Production in the latter year is expected to total \$65 million. Major manufacturers are ACEC, Philips, Martin Hestor, and Sony.

The Competitive Environment

Production of product category components in Belgium in 1973 totaled over \$100 million and is expected to increase to almost \$165 million in 1977. Foreign subsidiaries manufacturing in Belgium contributed more than 97% of the output in 1972. U.S. subsidiaries alone accounted for 55% of product category component production in that year.

Belgian-owned companies supply at most 2% of the total electronic components market. There is only one Belgian firm, Craft, manufacturing components within the product category; it produces color TV picture tubes.

Belgian-owned firms supply 10 to 20% of the market for relays. Among the companies manufacturing relays are COBAR Electronic, C.E.E., Contigea, E.R.E.A., E.S. Eupen, Gardy, Schreder, and Teco. Many of these companies also produce small amounts of specialized or custom-built components. Approximately 10% of the domestic market for quartz crystals is supplied by Electro-Dynamique Belge.

Several major U.S. companies have subsidiaries manufacturing electronic components in Belgium.

RCA manufactures power semiconductors and accounts for the largest share of the country's total annual production of transistors. Approximately 50% of RCA's output is exported. GTE/Sylvania in Tienen, which is the largest manufacturer of color TV picture tubes, exports most of its output.

International Brake & Rectifier Company S.A. (I.B.R.) manufactures cathode ray tubes, diodes, rectifiers, and IC's. It accounts for about two-thirds of Belgium's total annual output of IC's and for a large share of the country's annual production of diodes and rectifiers. The bulk of I.B.R.'s production is sold on the local market.

Bell Telephone N.V. produces a variety of components, including relays, connectors, inductors, capacitors, diodes, transistors, and resistors for telecommunications equipment manufacturing. This company is especially prominent in capacitor and resistor production. It exports a large proportion of its output.

ATEA (GTE) produces relays, connectors, and capacitors for in-house use. ACEC (Westinghouse) manufactures power rectifiers and transistors.

Other subsidiaries of U.S. firms in Belgium, with the components they manufacture shown in parentheses, are: Brundy-Electra (connectors); C.P. Clare International N.V. (relays, switches, and IC's); Electronic Memories (core memories); and Sprague Electromag S.A. (thickfilm hybrid microcircuits, resistor networks, and capacitors).

MBLE (Philips) is the largest foreign subsidiary producing components in Belgium. It is successfully marketing almost all types of components and is the country's largest manufacturer of capacitors and resistors. It also produces transistors, power diodes, varistors, thermistors, IC's, and color TV tubes. The Siemens subsidiary manufactures electronic components for industrial automation and control and communications equipment and is expanding its production facilities.

Belgian exports of product category components, growing at an average annual rate of about 12%, are expected to increase from \$85.5 million in 1973 to almost \$135 million in 1977.

Belgium's foreign trade statistics for electronic components are somewhat misleading, primarily because of the intercompany trade between Philips in the Netherlands and its Belgian subsidiaries. Philips operates a central warehouse in the Netherlands to which its subsidiaries send most of their component production. The company then supplies its Belgian customers from this warehouse.

Trade data also show a relatively high proportion of imports of electronic components from Germany, due in part to trade between ITT's subsidiaries in Germany and its subsidiaries in Belgium. In addition, some manufacturers from other foreign countries, including the United States, use Bel-

gium as a European central warehousing depot, importing components with quick turnover into the country and then exporting them to other countries in Europe.

The Netherlands is by far the leading foreign supplier of electronic components to Belgium. Dutch firms in 1972 accounted for 49% (\$37 million) of the Belgian import market for product category components. Following the Netherlands were Germany with an import market share of 21% (\$16 million), and France with a 10% (\$8 million) share.

Germany's AEG-Telefunken is one of the most important foreign suppliers of electronic components to Belgium. Other German firms active in the Belgian market are Bosch, Hellige, and Rohde & Schwarz. British suppliers include AB Electronic Components, Ferranti, GEC, Pye-TMC, and Plessey. Japanese firms selling in Belgium are Hitachi, Nikko, and Nippon Electric.

Many U.S. component manufacturers have made successful inroads in the Belgian market. These include: AMP, Amphenol-Tuchel, Beckman, Electronic Array, GE, General Semiconductor Industries, Harris Semiconductor, Intel, Intersil, International Rectifier, ITT, Monsanto, Motorola, National Semiconductor, Raytheon, RCA, Sylvania, Teledyne, Texas Instruments, and TRW.

Import duties.—Duties levied on product category components imported from the United States range from 6.5 to 17% of the cost, insurance, and freight (c.i.f.) value. A value-added tax (TVA) of 18% of the duty-paid value also is levied on im-

ports. This tax also is applied on domestically produced goods. Information on official duty rates applicable to specific products within the product category may be obtained from the U.S. Department of Commerce, Domestic and International Business Administration, Room 4217, Main Commerce, Washington, D.C. 20230.

Technical Requirements

The electrical power supply is either 380/220 volts, 3-phase, 4-wire, 50 hertz star connected with a ground neutral, or 220 volts, 3-phase, 3-wire, 50 hertz delta connected. Domestic electrical supply is 220 volts AC, although 110/115 volts is still used in some areas.

The metric system of weights and measures is the statutory standard in Belgium.

Published national standards for electronic components in Belgium may be obtained through the American National Standards Institute, Inc., 1430 Broadway, New York, N.Y. 10018.

The following market research study, upon which this Country Market Survey is based, is available on loan from the U.S. Department of Commerce, Domestic and International Business Administration, Room 1617M, Main Commerce, Washington, D.C. 20230:

"The Market for Electronic Components in Belgium," DIB 74-06-511, November 1973.

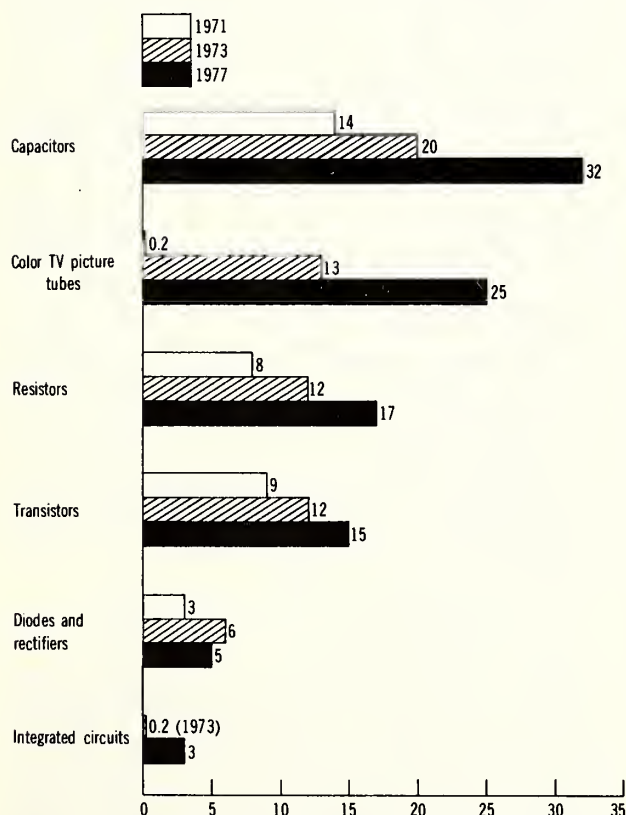
Brazil

Rapid expansion in Brazil's output of electronic end products is generating yearly increases in demand for electronic components.

The total 1972 market for all types of electronic components in Brazil was estimated at \$100 million, of which \$48 million was accounted for by the six selected groups of components covered in this survey (see table 1). Purchases of product category components rose to \$63 million in 1973, up \$15 million over the 1972 level. Projected increases, averaging about 12% a year, should result in a 1977 market of nearly \$100 million.

Brazil: Size of market for selected groups of electronic components, 1971-77

(in millions of U.S. dollars)



Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

Brazil's expenditures in 1972 for electronic components outside the product category included \$28 million worth of thyristors, special semiconductor devices, connectors, relays and switches, inductors, and quartz crystals, as well as \$24 million in black-and-white TV picture tubes and other types of components.

Brazilian total imports of product category components averaged over 38% of the total market in the 1971-73 period. Imports in 1973 were a record \$23 million, more than double the 1971 level of \$11 million. The share of the market represented by imports is forecast to decline from 36% in 1973 to about 21% in 1977, due to the anticipated rapid increase in local component production. The value of annual purchases of foreign-made components is projected to remain stable at over \$20 million during the same 5-year period. Nevertheless, the market bears close watching; further development of the electronics industry in the Manaus free port area and possible expansion of in-bond production elsewhere in Brazil of electronic end products for export could send imports sharply upward.

Product Category Definition

Electronic components covered in this survey are basically confined to resistors, capacitors, color TV picture tubes, diodes and rectifiers, transistors, and integrated circuits.

The term "product category" as used in this publication is limited to these six groups of components.

**Brazil—Selected Indicators
(1972)**

Gross national product:	\$50 billion
Population:	100 million
Total country imports:	\$4,890 million
Imports from U.S.	
(w/share of total):	\$1,370 million (28%)
Total country exports:	\$4,000 million
Exports to U.S.	
(w/share of total):	\$900 million (22%)
Exchange rate (May 1974):	6.37 cruzeiros=US\$1

American exporters sold \$6.3 million worth of product category components to Brazil in 1972, compared with \$3 million in 1971 and \$2.3 million in 1969 (see table 2). The U.S. share of total Brazilian imports of such components during that period ranged from 27 to 32%. Opportunities for the expansion of U.S. sales to this market will rise as manufacturing subsidiaries and licensees of American electronic firms increase their role in Brazil's electronics industry and as Brazilian Government agencies let major contracts for the supply of electronic telecommunications equipment.

Sales Opportunities

A market research survey recently conducted in Brazil for the U.S. Department of Commerce, Office of International Marketing reveals that favorable sales opportunities exist for American exporters of the following electronic components:

Transistors.—Brazilian manufacturers of television sets and other electronic end products bought an estimated \$12 million worth of transistors in 1973, of which \$8.5 million was imported. American-made silicon transistors accounted for approximately 30% (\$2.2 million) of total imports in 1972. Germanium transistors were imported from Mexico, Japan, and European countries.

In the process of developing end products with solid state circuitry, some manufacturers are expected to move directly to the production of equipment using integrated circuits, bypassing the discrete semiconductor stage. Nevertheless, the market for transistors is expected to reach \$15 million in 1977. Imports are projected to supply one-half of this total. U.S. firms will find especially favorable opportunities to sell silicon n-p-n power transistors.

Diodes, rectifiers, and thyristors.—Brazilian purchases of diodes and rectifiers amounted to \$5.2 million in 1972. This total consisted of an estimated 16.5 million silicon small signal diodes, nearly 13 million germanium diodes, 8.4 million silicon rectifiers, 1.3 million power rectifiers and thyristors, and 850,000 silicon zener diodes. Approximately 5 mil-

lion diodes were used in the assembly of telephone exchange equipment. The diode and rectifier market is expected to peak in 1975 and decline somewhat thereafter, returning to the 1972 level by 1977.

Brazil's current annual expenditures for thyristors total an estimated \$1.5 million. Trade sources report steady demand for silicon controlled rectifiers (SCR's) for use in industrial control equipment and for bidirectional triodes (TRIAC's), which are utilized for speed regulation in food blenders and similar products. Foreign suppliers are able to compete successfully with Brazil's only producer of thyristors. American exporters will find buyers interested in silicon zener diodes, power rectifiers, SCR's, and TRIAC's.

Brazil imported \$4.6 million worth of diodes, rectifiers, and thyristors in 1972, of which 22% were of U.S. origin. These figures do not include substantial quantities of diodes imported in "kits" for use by firms performing in-bond assembly of car radios and color TV chassis for export. Such imports are estimated to have totaled 27 million units in 1973 and may reach 55 million units in 1977. American exporters should continue to sell upward of \$1 million worth of diodes to Brazil each year through 1977. Rising domestic production of diodes does not threaten the American position in the market because output is limited to the simpler types of diodes not normally purchased from the United States.

Integrated circuits.—Sales of integrated circuits, which totaled \$150,000 in 1973, are expected to reach \$3.4 million in 1977. This forecast does not take into account the additional quantities of IC's which will continue to be imported by Brazilian-based subsidiaries of IBM, Texas Instruments, and Sanyo of Japan for use in electronic data processing equipment and pocket calculators manufactured primarily for export.

The market for integrated circuits is beginning to develop among Brazilian manufacturers of electronic consumer products, particularly among makers of television sets. It is expected that by 1977 approximately half of all Brazilian-made TV sets will incorporate IC's. Imports, mainly from the United States, France, and the Netherlands, are expected to supply the bulk of Brazilian IC requirements during the 1973-77 period.

Selected End-User Industries

Brazil's electronics industry is one of the most dynamic sectors in the country's rapidly expanding economy. Production of finished electronic products, estimated at \$325 million in 1972, has been rising at a rate well above the 9 to 11% increases recorded by the country's gross national product in recent years.

An almost insatiable demand for radios and

radio communication equipment formed the original basis for Brazil's thriving electronics industry in the days when radio was the principal means of communication among the cities and towns scattered over the country's 3.3 million square miles. Today, the manufacture of entertainment equipment is still the mainstay of the industry, accounting for up to 95% of electronic components consumption. The market for electronic telecommunications equipment, however, is rapidly growing in importance. Manufacturers are expected to require substantial imports of electronic components to produce new equipment for the expansion of Brazil's telecommunications network.

The Brazilian Government plays a strong role in developing the country's industrial sector. Strict controls on imports of competing products, generous incentives for exporters, and financial support to domestic firms for research and development are among the measures the Government has taken to attract and retain new industry. In addition, local manufacturers are usually permitted to import production equipment and components not produced domestically in return for their promises to gradually increase the domestic content of their products and to help develop Brazil's technological capabilities. Most of the leading multinational electronic firms have, therefore, found the economic and political climate in Brazil favorable enough to warrant the establishment of local manufacturing subsidiaries.

The Government has located the Manaus free port in Amazonas State as part of its overall effort to upgrade the economy of the Brazilian interior. The free port already has attracted leading Japanese electronics manufacturers. Sanyo, for example, has begun making pocket calculators in Manaus. Several American and European firms also are expected to open assembly plants there in the near future. These industries will be permitted to supply the domestic as well as the export market with goods made from imported duty-free materials. The firms have agreed, however, to gradually increase their use of Brazilian-made components.

To increase foreign exchange earnings and provide additional jobs throughout the country, the Government has begun to allow in-bond production of electronic consumer goods for export, with components and parts imported free of duty. These "special export projects" are established by agreement between the Government and the individual manufacturers. Unlike the Manaus ventures, these projects are not restricted to a specified geographic location. Firms seeking permission to set up "bonded factories" also are not required to make a commitment to increase the domestic content of their goods. However, measures are under consideration that would permit Brazilian suppliers to sell electronic components and other materials to

these bonded factories and receive the tax benefits applied to exports. The domestic manufacturers would still have to meet the duty-free import price of foreign-made components.

Consumer products sector.—Brazil's electronic entertainment products manufacturers can anticipate years of steady growth in the demand for their products (see table 3). Real increases in the purchasing power of workers in industrialized regions and progress in bringing electricity and television reception to Brazil's interior are boosting sales of black-and-white and color TV's as well as sales of phonographs, radio/phonograph combinations, and tape recorders/players. Sales of color TV's are not, however, rising as fast as had been expected. Their price is still prohibitive to most Brazilians, many of whom are just buying their first black-and-white set.

The demand for sophisticated audio equipment, such as tape recorders, stereo amplifiers, and speaker systems, is rising rapidly. Sales of tape recorders/players alone are estimated at 100,000 units per year. Imports were estimated at \$7.5 million in 1972, when Japan was the leading supplier. Domestic production is limited to the assembly (mainly by subsidiaries of Philips of the Netherlands) of stereo amplifiers and the simpler models of tape recorders.

Brazilian production of electronic photographic equipment is confined to modest quantities of electronic flash units. Transistorized clocks for industry and home use and solid state master control clocks are also manufactured on a limited scale.

Television receivers.—Eleven companies manufacture television sets in Brazil. Five of these are subsidiaries of or joint ventures with U.S. firms (Philco-Ford Corp., General Electric Co., GTE-Sylvania Inc., Admiral Corp., and Zenith Radio Corp.); two are subsidiaries of European manufacturers (Philips and AEG-Telefunken of Germany); and three are wholly Brazilian-owned (Colorado Radio e Televisao S.A., Semp Radio e Televisao S.A., and ABC Radio e Televisao S.A.).

Brazilian and U.S.-affiliated manufacturers have equal shares of the television receiver market; each group accounts for approximately 35 to 40% of total sales. European-affiliated producers are responsible for the remaining sales. Philco Radio e Televisao Ltda. and Colorado Radio e Televisao S.A. are the industry's undisputed leaders.

The three Brazilian-owned TV receiver manufacturers do not yet have the financial resources nor the technological capability to do more than adapt the key features of competing foreign products. They reportedly are seeking license agreements with foreign companies for the production of color TV sets.

The use of solid state circuitry in Brazilian tele-

Table 1.—Brazil: Size of market¹ for selected groups of electronic components, 1971-77
(in thousands of U.S. dollars)

Description	1971	1972	1973	1974	1977
<i>Resistors</i>					
Production ²	8,367	11,668	15,700	22,700	31,000
Imports	1,561	2,203	2,500	2,500	1,000
Exports	2,128	3,871	6,200	11,600	15,000
Market size	7,800	10,000	12,000	13,600	17,000
<i>Capacitors</i>					
Production ²	12,664	15,711	18,000	22,500	31,000
Imports	2,900	4,064	4,500	4,500	6,000
Exports	1,864	2,474	2,500	3,000	4,500
Market size	13,700	17,301	20,000	24,000	32,500
<i>Color TV picture tubes</i>					
Production ²	—	2,210	11,000	13,300	25,900
Imports	180	3,220	2,000	2,100	2,100
Exports	—	—	—	—	3,000
Market size	180	5,430	13,000	15,400	25,000
<i>Diodes and rectifiers</i>					
Production	514	618	1,000	3,200	4,700
Imports ³	2,911	4,635	5,060	3,200	1,700
Exports	24	58	60	200	1,200
Market size	3,401	5,195	6,000	6,200	5,200
<i>Transistors</i>					
Production ²	5,030	2,600	4,200	6,100	8,500
Imports	3,679	7,604	8,500	8,500	7,500
Exports	110	200	700	600	1,000
Market size	8,599	10,004	12,000	14,000	15,000
<i>Integrated circuits</i>					
Production	n.a.	n.a.	n.a.	n.a.	800
Imports ⁴	n.a.	n.a.	150	170	2,600
Exports	n.a.	n.a.	n.a.	n.a.	n.a.
Market size ⁵	n.a.	n.a.	150	170	3,400
<i>Totals</i>					
Production	26,575	32,807	49,900	67,800	101,900
Imports	11,231	21,726	22,710	20,970	20,900
Exports	4,126	6,603	9,460	15,400	24,700
Market size	33,680	47,930	63,150	73,370	98,100

¹ Size of market equals production plus imports minus exports; it does not include components imported for the special export projects (see page 10). Parts and accessories are not included.

² Production figures include components manufactured by OEM's for their own use. In-house production of resistors represents less than 1% of the total; capacitors, less than 10%; color TV picture tubes (1973), 32%; transistors, 50%.

³ Includes thyristors.

⁴ Imports by IBM do Brasil Ltda. and imports used in Manaus free zone assembly plants are not included.

⁵ Official data not available prior to 1973.

n.a.—Data not available.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

vision receivers is steadily increasing. Approximately 45% of the sets made in 1972 had some transistors. It is expected that by 1977 approximately half of all TV sets in Brazil will have integrated circuits. The assembly plants in Manaus are expected to use IC's.

SA Philips do Brasil is by far the most vertically integrated of Brazil's TV receiver manufacturers. The firm's corporate affiliates make TV picture tubes, transistors, fixed film and ceramic capacitors, carbon potentiometers, fixed carbon composition resistors, and fixed wirewound resistors, and soon will be producing wirewound potentiometers. Moreover, Philips has plants throughout

Latin America and can take advantage of the lower tariffs applicable to imports of electronic components from LAFTA (Latin American Free Trade Association) member nations.¹

Other Brazilian television manufacturers have acquired component manufacturing firms to ensure a steady supply of quality components and parts. ABC Radio e Televisao S.A. is the principal shareholder in Chelna S.A. Industrias Electronicas, a producer of fixed ceramic and electrolytic capacitors. AEG-Telefunken recently purchased a controlling interest in a leading domestic maker of fly-

¹ LAFTA member countries are: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico, Paraguay, Peru, Uruguay, and Venezuela.

back transformers, yokes, and channel selectors. GTE-Sylvania did the reverse. Originally, the company made only TV picture tubes at its Brazilian plant; later, it purchased a domestic television and radio manufacturing firm (Empire). Philco makes its own transistors, and Semp Radio e Televisao S.A. assembles black-and-white TV picture tubes.

Radios.—Brazilian production of radios is expected to climb by more than 15% per year between 1973 and 1977. Output of car radios may rise by 7% during the same period.

Ten companies account for the bulk of production. Brazilian-owned firms using domestically developed technology dominate the sector, despite important contributions made by subsidiaries of Philco, Philips, and Bosch (Germany). Nearly 75% of the 750,000 car radios and more than 50% of the 2.7 million other radios marketed in 1973 were made by Brazilian firms, notably Motoradio S.A. Commercial e Industrial, Nissei S.A. Industria e Comercio, Wansat Eletronica S.A., and Semp.

Industrial/commercial equipment sector.—The industrial/commercial sector of Brazil's electronic equipment industry is on the verge of major expansion to meet rapidly rising demand for both a larger volume and a wider variety of products. The telephone equipment industry is the largest in this sector and will be the first to feel the pull of the higher demand. Other electronic industrial/commercial equipment produced in Brazil includes computers and related equipment, pocket calculators, medical electronic equipment, measuring and test equipment, welding equipment, battery chargers, alarm systems, industrial process control equipment, electronic automotive equipment, variable speed transmission gears, and pollution control equipment.

Telecommunications equipment.—Brazil has always had an acute shortage of telephones. Government-controlled subscriber rates were kept too low to permit accumulation of funds for investment in expanded and modern facilities. Consequently,

there were only 2 telephones per 100 inhabitants before 1964, and more than half of Brazil's urban centers had no telephone service at all. Waiting periods of 2 years or more for telephone installation were common, due to the limited number of lines available.

The Government has made serious efforts since 1964 to solve the telecommunications problem. Subscriber rates were raised, and this provided telecommunications firms with sufficient income to invest in more modern equipment. A quasi-public corporation, EMBRATEL (Empresa Brasileira de Telecomunicacoes), prepared and carried out a 5-year plan to link the major state capitals with a 7,500-channel microwave system and to set up satellite communications with other countries. Initially criticized as overambitious, that plan has since proven to be inadequate to the demand, and Brazil has now begun another major expansion of its telecommunications network. While the earlier program dealt mainly with long-line interstate and international communications, current projects give greater attention to urban and intrastate facilities.

The Government began to reform the managerial and financial structure of the nation's 800 telephone companies in 1972. A publicly owned holding company, TELEBRAS, was organized to group each state's telephone companies around a preselected "polar" company in which TELEBRAS acquired a controlling interest. The capital obtained by the state telephone systems is being used to expand telephone networks, including interurban microwave systems that will link the state networks to EMBRATEL's interstate/international grid. (EMBRATEL is also under the jurisdiction of TELEBRAS, but has been granted considerable financial and administrative independence.) TELEBRAS hopes to install 1 million new phones a year during the period 1975-80 at a cost of approximately \$5 billion.

TELEBRAS is expected to switch in the near

Table 2.—Brazil: Imports from the United States, and U.S. share of total imports, of selected groups of electronic components, 1969-72¹
(in thousands of U.S. dollars)

Description	1969		1971		1972	
	Value	U.S. share (percent)	Value	U.S. share (percent)	Value	U.S. share (percent)
Resistors	375	34	453	29	475	22
Capacitors	911	36	745	26	382	9
Color TV picture tubes	—	—	—	—	1,900	32
Diodes and rectifiers	—	—	1,074	37	1,042	22
Transistors	1,016	29	—	—	—	—
Integrated circuits	—	—	722	20	2,253	30
Total	2,302	32	2,994	27	6,352	29

¹ Parts and accessories not included.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

Table 3.—Brazil: Size of market for consumer electronic products, 1969-77
(in thousands of units)

Description	1969	1971	1972	1973	1974	1977
<i>Television</i>						
monochrome	750	960	1,050	1,200	1,320	1,700
color	—	—	66	150	180	300
<i>Radios</i>						
automobile	430	600	700	750	800	1,000
other	1,120	1,650	2,220	2,700	3,240	4,200
<i>Phonographs, including portable, console, and radio/phono combinations</i>						
	270	405	410	460	500	600

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

future from the present system of crossbar exchanges to a more sophisticated semielectronic, or hybrid, exchange system. The company must decide first whether the new system will be one composed of discrete components that can be maintained by semiskilled personnel or a more advanced system using LSI modules.

Brazilian Government officials have been dissatisfied with certain foreign suppliers of telecommunications equipment because they feel the companies have failed to introduce their most modern equipment in Brazil. The Government decreed in August 1973 that TELEBRAS would participate in the capitalization of the Brazilian subsidiaries of manufacturers of telecommunications equipment so as to give TELEBRAS leverage to force the companies to offer a better product at lower prices. This controversial decree has since been toned down somewhat by official assurances to the industry that its implementation would be delayed.

Subsidiaries of leading foreign manufacturers have been making equipment for telephone systems in Brazil for many years. Ericsson do Brasil, S.A., a subsidiary of the Swedish firm, was the first to offer crossbar exchanges and took an early lead in the market. Ericsson now supplies approximately 50% of the market for new telephone equipment. Its production capacity reportedly is sufficient to turn out 200,000 telephones, 10,000 multiplex channels, and 150,000 loading cables per year. Standard Eletrica S.A., a subsidiary of ITT (U.S.), ranks second in the Brazilian market; it is followed by Plessey/ATE Telecomunicacoes Ltda. (U.K.), NEC do Brasil Eletronica e Comunicacoes, Ltd. (Japan), Siemens S.A. (Germany), GTE Telecomunicacoes Ltda. (U.S.), and Philips do Nordeste Ltda. (Netherlands).

Most of Brazil's telecommunications manufacturers are essentially assemblers of components and parts imported from their parent companies overseas. They generally use domestically made electronic components only when exhaustive pretesting and rigorous quality control have been exercised. Relays, relay coils, and wirewound resistors are

among the components made in Brazil that meet the electronic equipment domestic manufacturers' requirements.

Computers and related equipment.—Multinational companies are showing increasing interest in establishing subsidiaries to assemble computers and related equipment in Brazil for export to third countries. IBM and Burroughs already have Brazilian subsidiaries. IBM's production includes electric typewriters, tape drives, control units, keypunches, and verifiers, and may soon include teleprocessing equipment. IBM also manufactures a small computer—the System 3—in Brazil. Approximately 90% of the output of IBM's Brazilian subsidiary is exported; substantial quantities are shipped to Japan. Burroughs has a plant in Sao Paulo that produces ring-type ferrite memories.

IBM has been able to utilize increasing quantities of Brazilian-made electronic components in its products. Burroughs, however, imports all of its components from the United States. Its imports in 1973 included an estimated 3 million diodes.

The Competitive Environment

Brazil's electronic components industry is expanding rapidly, having largely overcome earlier difficulties in meeting the quality standards of potential customers. Output of the selected groups of components covered in this survey jumped from \$27 million in 1971 to \$33 million in 1972 and \$50 million in 1973. Local component production in 1977 is forecast to exceed \$100 million, more than double the 1973 level, and will be sufficient to supply manufacturers of electronic end products for the domestic market with all but the most specialized types of product category components. Domestic component manufactures, however, are as yet reluctant to expand their production to the extent necessary to supply the anticipated needs of the "bonded factories." They have observed that component production worldwide is subject to geographical shifts. They consequently feel that the presence of the "special export projects" in Brazil may be short-lived.

Brazil exports significant quantities of product category components, mainly to her partners in LAFTA. Exports of these components could total nearly \$25 million in 1977, compared with \$9.5 million in 1973. Resistors are the biggest sellers, particularly fixed and variable carbon composition resistors and, more recently, mylar and styroflex fixed-film resistors. Foreign-owned firms do most of the exporting of components. Brazilian subsidiaries of Philips are particularly active in this regard. U.S. affiliated companies, however, export only small quantities. General Electric S.A. and Arbame-Mallory S.A. ship some of their output of fixed capacitors to their U.S. parent firms. Other subsidiaries and licensees of American manufacturers are believed to be selling a total of \$500,000 worth of product category components annually to customers in LAFTA nations.

Brazilian exporters of electronic components benefit from several Government incentives. Among these are a rebate of customs duties paid on imported raw materials and parts used in production, reductions on corporate income taxes based on a percentage of the difference between domestic and export sales, exemption from domestic sales taxes, access to low-cost investment capital, and assistance with export financing.

Manufacturers of the selected groups of electronic components covered in this survey include 12 wholly Brazilian-owned companies and 17 subsidiaries of American, Japanese, German, Dutch, French, and Italian firms. U.S.-affiliated firms are believed to account for approximately 25 to 30% of Brazil's total output of product category components. Their production is primarily for use in-house.

Three firms—a Brazilian-owned company and two subsidiaries of Philips—produce most of Brazil's resistors. Constanta Eletronica S.A. (Philips) is the undisputed leader. Constanta, which exports most of its products, plans to increase its annual production capacity from 800 million to 2 billion fixed and variable resistors per year. Another Philips subsidiary, Telewatt do Brasil Ltda., recently added miniature wirewound potentiometers to its product line to supply domestic manufacturers of color TV sets. Resistencias Brasileiras S.A., anticipating continued strong export demand, is increasing its output capacity from 50 million to 200 million resistors per year. A major Japanese manufacturer of resistors, attracted by Brazil's low production costs, is building a plant that should begin operating in the near future.

Capacitors.—Capacitors are manufactured in Brazil by six locally owned firms and by subsidiaries of three U.S. and five other foreign firms. Japanese technology and/or capital is utilized by two producers of electrolytic capacitors (Chelna S.A. Industria Electronica and Kanda Industria Electronica

Ltda.) and may soon be used by a third (Industria de Condensores Eletroliticos Log Ltda.). The market leader, however, is Icotron S.A. Industria de Componentes Eletronicos, a subsidiary of Siemens AG of Germany. Arbame-Mallory S.A., in which Mallory of the United States holds a financial interest, makes small and medium-size tubular capacitors and large (AC) capacitors. Philips ceased production of electrolytic capacitors in Brazil and is now importing them from an affiliate in Mexico.

The manufacture of ceramic capacitors is dominated by Mialbras S.A. (subsidiary of Mial of Italy), Thomson-CSF Componentes do Brasil Ltda. (subsidiary of the French firm of the same name), and Chelna (under license from Kawabata Condensor Co. and Elna Co. of Japan). These companies presently produce disc and tubular capacitors. Some of the manufacturers that had limited their operations to the processing of imported ceramic discs are beginning to make their own discs.

Mialbras and Icotron lead in supplying fixed-film capacitors to the major international end-product manufacturers operating in Brazil. However, Ibrape (Industrial Brasileira de Produtos Eletronicos e Eletricos S.A., a Philips subsidiary) is also a strong competitor. General Electric S.A., a subsidiary of the U.S. firm, makes fixed-film capacitors solely for its own use. Small quantities of polyester fixed-film capacitors are manufactured by the Brazilian-owned companies, Industria Eletronica Argos S.A. and Industria Eletronica Cherry S.A. Argos and Cherry are also the only manufacturers of paper capacitors, the first type of capacitor to be made in Brazil.

Color TV picture tubes.—Color television picture tubes are manufactured or assembled by three companies—GTE Sylvania Industria e Comercio Ltda. (U.S.), RCA Eletronica Ltda. (U.S.), and Ibrape (Philips). RCA is the only one of the three not presently making television sets as well as picture tubes, but this situation may change in 1974 or 1975.

Brazilian manufacturers make only the 20" to 26" size TV picture tubes; smaller sizes are imported. The extent to which domestic manufacturers will supply the total domestic market for the larger tubes depends mainly on the success of the Manaus-based operations. Color TV sets assembled there will enter Brazil equipped with picture tubes imported through the free port.

Diodes and rectifiers.—Brazil has only one manufacturer of diodes at present, although Philco, Icotron, and Ibrape may be producing some diodes from rejected transistors. Semicron Sudamericana Comercio e Industria Semicondutores Ltda., a subsidiary of Semikron of Germany, makes silicon and selenium rectifier assemblies, rectifier diodes, and thyristors. Semicron is beginning the production of

small diodes in its newly enlarged plant; it expects to produce 1 million units per month in 1974. Fairchild Semicondutores (U.S.) is planning to set up a factory with the capacity to produce 50 million diodes per year. CSF may soon add 12 to 15 million diodes per year to its line of capacitors and transistors.

Transistors.—Transistors are being manufactured by the component divisions of Philco Radio e Televisao Ltda. and by Ibrape, Icotron, Industria Electronica Sanyo do Brasil Ltda. (Japan), and CSF. Philco, whose in-house needs absorb nearly all its output, uses the diffusion process on imported wafers and masks. The other firms start production with imported chips. Ibrape (Philips) exports a good part of its output of 4.5 to 6 million metal-cased SiSS transistors and plans to export most of its anticipated 1974 production of 15 to 20 million epoxy SiSS transistors.

The first Brazilian-owned transistor manufacturer, Transit Semiconductors S.A., is now operating a plant in the State of Mina Gerais on an experimental basis. Using technology developed at the University of Sao Paulo, Transit expects to begin commercial production of transistors and, eventually, of integrated circuits. The Government is giving Transit financial support for its research and development through SUDENE, an agency charged with promoting the industrial development of northeastern Brazil.

Integrated circuits.—Integrated circuits are produced in Brazil exclusively by Texas Instruments at a factory in Campinas, near Sao Paulo. Imported, pre-tested monolithic digital chips are diced, wire-bonded, encapsulated, and given final tests in the Campinas plant. All these IC's are exported to the parent firm in the United States. Transit is the only other company that has announced plans to manufacture integrated circuits in Brazil.

American electronic component exporters wishing to sell their products in Brazil will find it essential to set up sales offices or competent exclusive representation in the country. It is also necessary sometimes to approach leading multinational users via their central purchasing offices in other countries. Component users are accustomed to dealing with the manufacturer through his local representa-

tive; distributors play a relatively minor role in the marketing process. Furthermore, importation is always a complicated process in which sales offices can be of invaluable help. There are detailed requirements for labeling, documenting, and shipping goods to Brazil; when they are not followed, goods are delayed or refused at the port of entry or subject to heavy fines payable by the customer. Failure to meet these requirements, and the ensuing difficulties, is the source of most complaints against U.S. suppliers.

Import duties.—Brazilian customs duties applicable to electronic components imported from the United States generally range from 15 to 55% of the cost, insurance, and freight (c.i.f.) value. Certain coils and synchronizers are dutiable at 70% of the c.i.f. value. Duties on transistors and receiving tubes are assessed on the basis of minimum values per unit of \$0.25 and \$0.38, respectively. Information on official duty rates applicable to specific products within the product category may be obtained from the U.S. Department of Commerce, Domestic and International Business Administration, Room 4217, Main Commerce, Washington, D.C. 20230.

Technical Requirements

The characteristics of electrical power supply in most areas of Brazil are 110-220 volts, 60 hertz, single- and 3-phase.

The metric system of weights and measures is the statutory standard in Brazil.

Published national standards for electronic components in Brazil may be obtained through the American National Standards Institute, Inc., 1430 Broadway, New York, N.Y. 10018.

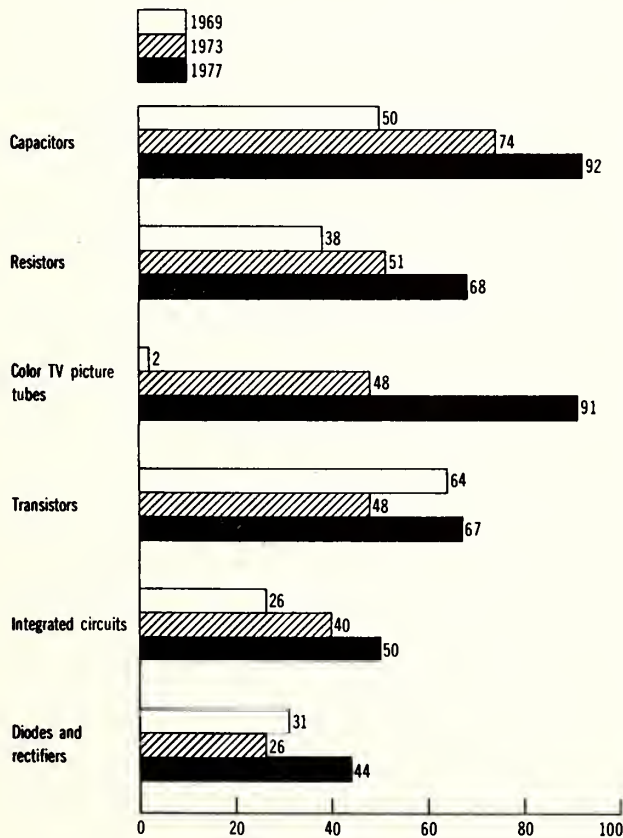
The following market research study, upon which this Country Market Survey is based, is available on loan from the U.S. Department of Commerce, Domestic and International Business Administration, Room 1617M, Main Commerce, Washington, D.C. 20230:

"The Market for Electronic Components in Brazil,"
DIB 74-04-501, November 1973.

France

France's electronics industry output, placed at \$3.5 billion in 1972, is expected to expand at an annual rate of between 15 and 20% in the years just ahead. Determined efforts by the country's manufacturers to increase their shares of the rapidly expanding domestic and overseas markets for electronic products underlie this projection. These industry efforts are strongly supported by the French Government through substantial R&D funding. Factors such as these should have a most positive influence on the expanded use of high-technology electronic components in France through the 1970's.

France: Size of market for selected groups of electronic components, 1969-77
(in millions of U.S. dollars)



Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

The French market for the selected groups of electronic components covered in this survey is expected to climb from a 1973 level of \$288.4 million to almost \$412 in 1977, representing an average annual growth rate of more than 9%.

France's imports of products category components in 1973 amounted to \$128.6 million, accounting for about 45% of the total market. The value of imports is forecast to approach \$155 million in 1977.

The United States is a principal supplier of product category components to France. U.S. manufacturers were the source of more than one-third of that country's annual imports in recent years (see table 2). France's purchases of American-made components increased 44% between 1969 and 1972, climbing from \$29.2 million to \$42 million. U.S. exporters can anticipate sales to France in excess of \$50 million in 1977 if they retain their current share of the import market.

Sales Opportunities

A market research survey recently conducted in France for the U.S. Department of Commerce,

Product Category Definition

Electronic components covered in this survey are basically confined to resistors, capacitors, color TV picture tubes, diodes and rectifiers, transistors, and integrated circuits.

The term "product category" as used in this publication is limited to these six groups of components.

**France—Selected Indicators
(1972)**

Gross domestic product:	\$231 billion
Population:	50.3 million
Total country imports:	\$26.6 billion
Imports from U.S.	
(w/share of total):	\$2.2 billion (8.1%)
Total country exports:	\$25.7 billion
Exports to U.S.	
(w/share of total):	\$1.4 billion (5.3%)
Exchange rate (May 1974):	4.87 francs=US\$1

Office of International Marketing reveals that favorable opportunities exist for American exporters of the following electronic components:

Integrated circuits.—The French market for integrated circuits reached \$40 million in 1973, compared with \$22.2 million in 1971. An expected average annual growth rate of nearly 6% points to a \$50-million market in 1977. Imports in 1973 amounted to \$20 million, up from \$3.4 million in 1971. The import market is forecast to rise to \$26 million in 1977, a 30% increase over the 1973 level.

The United States is the dominant foreign supplier of integrated circuits to France. Imports from the United States soared from \$400,000 in 1969 to \$11.2 million in 1972. U.S. exporters enjoyed a 57.1% share of the import market in the latter year. Trade sources forecast that sales of American-made IC's to France may total nearly \$15 million in 1977. French buyers are particularly interested in the following types of American-made IC's: analog (linear), TTL, hybrid, COS/MOS digital, and power Darlington.

Transistors.—Total French purchases of transistors increased approximately 48% between 1971 and 1972, rising from \$32.8 million to \$48.4 million. Based on a predicted 8.5% average annual growth rate, the market for transistors is projected to approach \$67 million in 1977. Imports in 1973 totaled \$26 million, up \$4 million over the 1971 figure. The import market is expected to reach \$28 million in 1977.

The United States, a leading foreign supplier of transistors to France, held a 48.5% share of the import market in 1972. U.S. exporters increased their sales from \$1.4 million in 1971 to \$13 million in 1972. With little variance anticipated in relative import market shares during the next several years, France's transistor purchases from the United States should exceed \$13.5 million in 1977. The types of transistors offering best U.S. sales opportunities are small signal transistors; silicon high voltage, n-p-n, power transistors; silicon diffused solution

transistors; and silicon switching (power) transistors.

Capacitors.—Sales of capacitors, which rose from \$54.2 million in 1971 to \$74.4 million in 1973, are expected to exceed \$92 million in 1977. Imports are expected to reach \$26.2 million in 1977, up \$2.2 million over the 1973 figure and an increase of \$7.6 million over the 1971 level.

U.S. suppliers accounted for over 25% of French imports of capacitors in 1972 with sales of \$6 million, up from \$5.4 million in 1969. American-made capacitors commanding high customer preference in France include fixed electrolytic capacitors, fixed ceramic capacitors, fixed tantalum capacitors, and fixed paper capacitors.

Resistors.—French expenditures for resistors rose from \$44.8 million in 1971 to \$51.2 million in 1973. They are expected to increase an average of 7.3% yearly, reaching \$68 million in 1977. Imports are expected to increase more than 22% between 1973 and 1977, rising from \$15 million to \$17.6 million.

The U.S. share of France's import market for resistors was 30.6% in 1972. This represented \$4.4 million in sales, up from \$3.4 million in 1969. If U.S. suppliers continue to hold over a 30% share of the French import market, they can anticipate roughly \$5.5 million in sales of resistors in 1977. French demand for U.S.-origin resistors is expected to be strongest for such types as fixed film resistors, fixed composition resistors, and potentiometers.

Diodes and rectifiers.—The market for diodes and rectifiers, valued at \$26 million in 1973, is expected to grow at an average annual rate of 14% to more than \$44 million in 1977. Due to growing domestic production, imports appear likely to remain stable at around a \$12-million annual level during the 1973-77 period.

U.S. suppliers, with \$4.4 million in sales to France in 1972, accounted for a 34.4% share of the import market for diodes and rectifiers in that year. They will find that their best near-term sales prospects lie in silicon diodes, zener diodes, diode assemblies, and power rectifiers.

Color TV picture tubes.—Purchases of color TV picture tubes in 1973 by French manufacturers of television receivers reached \$48.4 million, more than double the 1971 figure of \$21 million. Anticipated annual increases averaging approximately 17% should boost sales to over \$90 million in 1977. Imports increased more than 25% between 1971 and 1973, climbing from \$12.2 million to \$31.4 million. The value of imports in 1977 is projected to approach \$44 million, growing at an 8.5% average annual rate from the 1973 level.

The U.S. share of France's total imports of color TV picture tubes was 10.6%, or \$3 million, in 1972. This compares with purchases from the

United States of \$1 million in 1971. If the U.S. share of imports remains at present levels, French purchases from the United States should exceed \$4.6 million in 1977.

Selected End-User Industries

The electronics industry in France is one of the world's largest. In 1972, it comprised approximately 570 manufacturing enterprises with a total of 171,000 employees. The Government's Sixth Plan for Economic and Social Development (1971-75) calls for an average annual increase of about 17% in the electronics industry's output.

The French Government has committed itself to assisting the electronics industry—particularly French-owned firms—capture a large share of the rapidly expanding world markets. Competition is mounting, now that import duties have been abolished on electronic end products and components traded among European Economic Community (EEC) member nations. Furthermore, the EEC has negotiated a trade agreement with leading Asian supplying countries that permits the importation by Common Market members of substantial quantities of electronic products at favorable rates of duty.

The Government therefore is encouraging leading firms in each sector of the industry to combine their marketing efforts in order to compete with major foreign manufacturers in both the domestic and export markets. This policy has been most fully implemented in the electronic data processing industry under the Plan Calcul.

In an attempt to increase the technological sophistication of domestic manufacturers' products, the Government in recent years has been subsidizing approximately 60% of the industry's research and development (R&D) costs and also has funded a number of projects to be carried out in Government research facilities. The Sixth Economic Development Plan calls for combined public and private expenditures of \$1.8 billion for R&D in the electronics industry during the 1971-75 period: \$516 million for telecommunications equipment; \$466 million for measuring instruments, aircraft and ground navigation systems, and aerospace electronic products; \$433 million for EDP equipment; and \$419 million for components.

Five highly integrated major holding companies dominate the French electronics industry. Three of them—Thomson-Brandt, Compagnie Generale d'Electricite (CGE), and Compagnie Francaise Philips (a subsidiary of the Dutch firm)—together accounted for 85% of the industry's total sales in 1971.

The Thomson-Brandt group, wholly French-owned, is the giant of the industry, employing more than 80,000 workers at 75 manufacturing and research facilities. The company reported aggregate

France—The Electronic Industry Basic Data (1972)

Total value of production:	\$3.5 billion
Number of manufacturers:	570
Industry labor force:	171,000
Output of principal electronic components user industries—	
Consumer products industries:	
radio and television sets	\$498 million
audio equipment	\$92 million
watches and clocks	\$180 million
Industrial/commercial equipment industries:	
computers and related equipment	\$1.3 billion
communications equipment	\$752 million
measuring and testing instruments	\$180 million
control equipment	\$200 million
medical electronic equipment	\$60 million

1971 sales in excess of \$1 billion. Thomson subsidiaries are active in both the consumer and industrial/commercial electronics products sectors.

Two of France's leading computer manufacturers—Compagnie Internationale pour l'Informatique (CII) and Compagnie des Compteurs—are members of the Thomson group. Other Thomson affiliates include Continental Edison, which makes radios, television receivers and audiovisual equipment; Groupement des Applications Nucleaires et de l'Instrumentation Scientifique (GANIS), France's leading producer of engineering and scientific instruments; and several makers of electronic components.

Companie Generale d' Electricite (CGE), a French-owned manufacturer of electrical and electronic products, is much less diversified in electronics production than Thomson. CGE's telecommunications division and CIT-Alcatel, a leading microelectronics producer, are the main contributors to the group's annual sales.

The most important manufacturing affiliates of Compagnie Francaise Philips are La Radio Technique Compelec (RTC), a component manufacturer with annual sales of \$140 million; and La Radio Technique, a consumer electronics producer, which had a \$130 million sales volume in 1971.

Some 245 of the 570 French electronics manufacturers are subsidiaries of foreign firms—mainly U.S. corporations. Compagnie IBM France and the ITT group, raking fourth and fifth among France's electronics manufacturers in terms of 1970 sales, serve to illustrate the commanding position of U.S.-

Table 1.—France: Size of market¹ for selected groups of electronic components, 1969-77
(in millions of U.S. dollars)

Description	1969	1971	1972	1973	1974	1977
<i>Resistors</i>						
Production ²	33.0	34.6	40.0	46.8	54.8	68.0
Imports	7.8	15.8	14.4	15.0	15.4	17.6
Exports	2.8	5.6	7.8	10.6	13.8	17.6
Market size	38.0	44.8	46.6	51.2	56.4	68.0
<i>Capacitors</i>						
Production ²	43.4	47.6	54.0	63.0	69.6	90.0
Imports	16.4	18.6	23.8	24.0	24.0	26.2
Exports	9.6	12.0	14.4	12.6	20.0	24.0
Market size	50.2	54.2	63.4	74.4	73.6	92.2
<i>Color TV picture tubes</i>						
Production ²	—	24.0	46.0	55.2	66.4	86.0
Imports	2.0	12.2	28.2	31.4	35.0	43.6
Exports	—	15.2	38.2	38.2	38.2	38.8
Market size	2.0	21.0	36.0	48.4	63.2	90.8
<i>Diodes and rectifiers</i>						
Production ²	29.6	29.6	29.6	32.8	35.8	44.2
Imports	9.2	13.2	12.8	12.2	12.2	12.2
Exports	7.8	9.6	12.6	19.0	12.0	12.0
Market size	31.0	33.2	29.8	26.0	36.0	44.4
<i>Transistors</i>						
Production ²	59.4	59.4	59.4	65.2	71.8	88.8
Imports	28.8	22.0	26.8	26.0	26.0	28.0
Exports	24.4	48.6	42.4	42.8	46.6	50.0
Market size	63.8	32.8	43.8	48.4	51.2	66.8
<i>Integrated circuits</i>						
Production ²	25.0	21.0	29.0	31.8	35.0	43.0
Imports	1.0	3.4	19.6	20.0	24.0	26.0
Exports	—	2.2	8.0	11.8	17.0	19.4
Market size	26.0	22.2	40.6	40.0	42.0	49.6
<i>Totals</i>						
Production ²	190.4	216.2	258.0	294.8	333.4	420.0
Imports	65.2	85.2	125.6	128.6	136.6	153.6
Exports	44.6	93.2	123.4	135.0	147.6	161.8
Market size	211.0	208.2	260.2	288.4	322.4	411.8

¹ Size of market equals production plus imports minus exports. Parts and accessories not included.

² Production figures include components manufactured by OEM's for their own use.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

owned companies. IBM is France's leading exporter of electronic equipment, shipping nearly 50% of its French production to other countries. ITT subsidiaries in France include Compagnie Generale Construction Telephonique, an important maker of telecommunications equipment, and two firms manufacturing consumer electronic products, Sonolor and Oceanic. ITT Division MTI and ITT Division Intermetall make electronic components.

Other U.S.-affiliated producers that hold a strong position in the French electronics industry include Ampex Corp.; Burroughs Corp.; Control Data Corp.; Fairchild Camera and Instrument Corp.; Honeywell, Inc.; Hewlett-Packard; Motorola, Inc.; Texas Instruments, Inc.; the National Cash Register Co.; Teradyne; and Tektronix, Inc.

Aggregate 1972 purchases of electronic components by subsidiaries of U.S. firms in France totaled

an estimated \$150 million. Product category components accounted for \$65 million of this total.

Industrial/commercial equipment sector—More than two-thirds of the 1972 output of the entire electronics industry in France consisted of industrial, commercial, and military electronic equipment. Manufacturers in this sector are estimated to have utilized \$410 million of electronic components in that year. Both production and exports of electronic industrial and commercial equipment are expected to rise sharply during the 1973-77 period. The most dynamic growth should occur in the areas of telecommunications equipment, scientific and measuring instrumentation, and electronic data processing and related equipment.

The industrial/commercial equipment sector, which includes publicly owned firms as well as private enterprises, is heavily subsidized and exten-

sively regulated by the Government. Public purchasing policies favor French-owned firms and, in some cases, "informal" quotas inhibit foreign competition.

Computers and related equipment—Production of computers and related equipment totaled close to \$1.3 billion in 1972. Approximately half of the industry's 1972 output consisted of medium-size commercial EDP systems. Small systems designed for industrial use accounted for 20%; large computers, for 10%; and peripherals, for 20%. The industry's electronic components technology is characterized as 50% discrete transistors/diodes, 40% TTL, and 10% MOS.

Three companies form the nucleus of France's thriving computer industry. IBM France, Honeywell-Bull, and CII account for 90% of the country's EDP hardware production; approximately 50 smaller firms share in the remainder. Control Data Corporation's French subsidiary along with Sintra, a member of the Thomson group, are leading manufacturers of computer-related equipment and dedicated systems.

IBM France has four manufacturing facilities in France. One of them, in Nice, specializes in research on software systems and produces some electronic components. A second, in Corbeil-Essones, also makes electronic components. The IBM factory in Montpellier assembles approximately 100 small and medium-size central processing units per month, and a plant in Bordeaux assembles the IBM 370. In 1970, approximately 12,000 production workers were on the IBM France payroll, in addition to hundreds of engineers, technical specialists, and administrative personnel.

Honeywell-Bull makes small and medium-size computers at its plant in Angers and peripheral equipment at a factory in Belfort. The Angers facility produced more than 800 of the smaller systems in 1972. Approximately 4,200 workers are employed in Honeywell's plants, and an additional 1,300 work in laboratories where research on small-system technology and software is conducted.

CII is the product of a merger of two French computer manufacturers sponsored by the Government under the Plan Calcul formulated in the mid-1960's. The company reported total sales of \$160 million in 1972. Since its formation, CII has been the recipient of substantial Government aid in the form of both direct and indirect subsidies. It received an estimated \$114 million under the Fifth Economic Development Plan and \$138 million under the Sixth Plan. Furthermore, CII is given preference in filling Government orders, which account for 20% of total domestic sales of EDP equipment. CII increased its share of Government business from 10 to 25% between 1970 and 1972; IBM's share in the latter year was 54% and Honeywell's was 11%.

Other entities created by the Government under Plan Calcul include Sperac, a manufacturer of peripherals; Intertechnique, which makes minicomputers; an EDP research center (Institut de Recherche d'Informatique et d'Automatique-IRIA); and a computer leasing firm (CIILOMI).

In an effort to expand its export markets, currently limited to EEC nations and former French colonies in Africa, CII has joined Siemens of Germany and Philips of the Netherlands in a marketing association called UNIDATA. Another recently established organization, PERI-INFORMATIQUE, will represent a group of leading French manufacturers of peripherals in world markets.

Telecommunications equipment—In anticipation of a high level of Government spending to improve France's telecommunications network, virtually all 20 of the country's telecommunications equipment manufacturers have undertaken or are planning major expansion and modernization of their production facilities. Approximately 38,000 people are employed by these companies. The 1972 output of telecommunications equipment was placed at \$752 million.

The Sixth Plan has allocated the telecommunications industry \$516 million for research, includ-

Table 2.—France: Imports from the United States, and U.S. share of total imports, of selected groups of electronic components, 1969-72¹
(in millions of U.S. dollars)

Description	1969		1971		1972	
	Value	U.S. share (percent)	Value	U.S. share (percent)	Value	U.S. share (percent)
Resistors	3.4	43.6	3.6	22.8	4.4	30.6
Capacitors	5.4	32.9	5.6	30.1	6.0	25.2
Color TV picture tubes	—	—	1.0	8.2	3.0	10.6
Diodes and rectifiers	3.6	39.1	6.6	50.0	4.4	34.4
Transistors	16.4	56.9	11.4	51.8	13.0	48.5
Integrated circuits	0.4	40.0	2.5	73.5	11.2	57.1
Total	29.2	44.8	30.7	36.0	42.0	33.4

¹ Parts and accessories not included.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

ing \$169 million for the development of an electronic switching system. To meet the urgent needs of computer users, work is proceeding on the high-speed HERMES data communications network scheduled for completion in 1978-80. The recent decision of the national broadcasting authority Organisation Radio-Television Francaise (ORTF), to provide cable TV service in rural areas of France should further stimulate Government spending for telecommunications equipment.

Consumer products sector.—French manufacturers of consumer electronic products are boosting production in order to win a larger share of the expanding domestic market. Until recently, the number of television sets and radios owned by French families was relatively low because of high sales taxes levied at the time of purchase and use taxes levied each year thereafter. Now, however, rising prosperity permits growing numbers of Frenchmen to purchase color televisions, radios, audio equipment and tape players.

The total French market for television receivers, valued at \$260 million in 1971 and \$420 million in 1973, is forecast to reach \$530 million in 1975. Sales of color sets rose from 320,000 units in 1971 to 560,000 sets in 1973 and are expected to reach 790,000 sets in 1975. Makers of audio equipment anticipate 1975 sales of almost \$226 million, up from \$142 million in 1973 and \$93 million in 1971.

Recent sharp increases in imports of radios from Southeast Asia alarmed domestic manufacturers, but the increased popularity of car radio/tape player combinations has enabled these companies to realize significant gains in total sales volume despite their losses in the market for other radios. The radio industry anticipates sales of over \$94 million in 1975, compared with \$50.3 million in 1971 and \$73 million in 1973.

The Competitive Environment

French production of the six selected groups of electronic components covered in this survey amounted to approximately \$295 million in 1973. Market analysts predict that output will rise an average of about 9% per year, reaching \$420 million in 1977. Exports, mainly to Germany, Italy, and other EEC member nations, are projected to increase from \$135 million in 1973 to more than \$160 million in 1977.

In the interest of reducing dependence on imports and upgrading the domestic electronics industry's technology, the Government is urging component manufacturers to expand their output of mass-produced components used by domestic computer and consumer electronics manufacturers, and MOS and ECL high-speed IC's required by telecommunications equipment firms. At the same time, producers of passive components are being encour-

aged to intensify their R&D on capacitors, potentiometers, connectors, and printed circuits.

More than 100 firms are engaged in the manufacture of electronic components in France. Approximately 40 companies can be considered to have a significant impact on the market; of these, 30 are French-owned, 7 are subsidiaries of leading U.S. manufacturers, and 3 are subsidiaries of major European firms.

Thomson/CSF, whose eight component-manufacturing subsidiaries produced an estimated \$160 million worth of electronic components in 1972, is the major French-owned manufacturer in this sector of the industry. Its product line includes the complete range of active and passive components. The French Government hopes to establish an internationally competitive semiconductor manufacturing group based on Sescosem, a Thomson subsidiary. The output of Sescosem's manufacturing plant, probably the industry's most advanced, has doubled each year since 1969. Thomson has already taken steps to improve its international position through the formation, with RCA, of the Videocolor Company, a joint venture which will mass-produce color TV picture tubes for the European market.

IBM France, one of the seven leading U.S.-owned companies in the country, manufactures electronic components exclusively for its own use. The company's 1972 production of components totaled approximately \$30 million.

The other six subsidiaries of U.S. firms make electronic components for their own use, for their affiliates in other European Common Market countries and, to a lesser extent, for independent French manufacturers of electronic end products. Only small quantities are exported to their parent firms in the United States. Societe Motorola-France, Societe Texas Instruments-France, and Societe TRW specialize in semiconductors; ITT subsidiaries make capacitors, transistors, relays, switches, and connectors. Societe Sprague (Sprague Electric) makes resistors, capacitors, inductors, and transformers. Societe Sovcor/Corning Glass manufactures resistors and capacitors. The six firms together employ a total of approximately 7,500 persons. Their 1972 sales of electronic components were estimated at \$80 million.

La Radio Technique Compelec (RTC), a member of the Philips group, is the second largest electronic components manufacturer in France and the leader in the production of color TV picture tubes for both the domestic and export markets. RTC also makes semiconductors, microelectronics, electron tubes, passive components, and electronic subassemblies. RTC exports approximately 35% of its production.

Other foreign-owned companies manufacturing

electronic components in France are Societe Siemens, a subsidiary of the German firm, and Societe SGS/ATES, an Italian-owned enterprise. Siemens' French factory makes semiconductors, thyristors, and diodes. SGS/ATES specializes in discrete transistors.

French-owned electronic components firms, in general, have been underfinanced and reluctant to make investments in original research and development at a level that would enable them to keep ahead of the rapid obsolescence of their products. Most of the technology they employ has been acquired through licensing agreements with foreign, mainly American, producers. Government support may improve this situation. The Sixth Plan calls for expenditures of \$419 million in public and private funds specifically for research and development in the electronic components industry. Areas selected for special emphasis are semiconductors, memory grids, and laser applications.

Import duties—Customs duties on product category electronic components imported from the United States range from 8 to 17% of the cost, freight, and insurance (c.i.f.) value. Taxes imposed on imported components to compensate for the turnover and value-added taxes levied on domestically produced components amount to 20%. Information on official duty rates applicable to specific

components within the product category may be obtained from the U.S. Department of Commerce, Domestic and International Business Administration, Room 4217, Main Commerce, Washington, D.C. 20230.

Technical Requirements

The characteristics of electrical power supply in France are 220/380 volts, 50 hertz, single- or 3-phase.

The metric system of weights and measures is the statutory standard in France.

Published national standards for electronic components in France may be obtained through the American National Standards Institute, Inc., 1430 Broadway, New York, N.Y. 10018.

The following market research study, upon which this Country Market Survey is based, is available on loan from the U.S. Department of Commerce, Domestic and International Business Administration, Room 1617M, Main Commerce, Washington, D.C. 20230:

"The Market for Electronic Components in France," DIB 74-02-511, October 1973.

Germany

Germany is the world's largest market for electronic components after the United States and Japan. Its total consumption of electronic components is predicted to exceed \$1.7 billion in 1977, up from approximately \$1.4 billion registered in 1973.

Total German purchases of the selected groups of components covered in this survey more than doubled in value between 1971 and 1973, climbing from \$443.8 million to \$902 million (see table 1). Forecasts indicate that the market for product category components will increase an average of 20% a year during the 1974-77 period, rising from \$1 billion to almost \$1.2 billion.

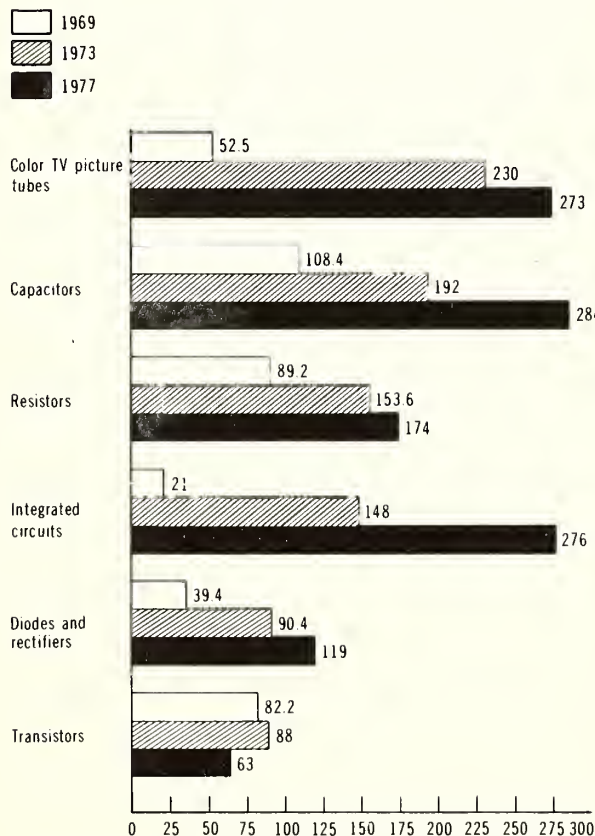
Imports of product category components averaged over 40% of the market during the 1971-73 period. Annual imports advanced 135% during that period, rising from \$169.7 million to \$398.8 million. Germany is tending to become more reliant on imports as cost pressures and labor shortages cut the domestic electronic components industry's capacity to meet growing local demand. The import market is expected to increase from about \$436 million in 1974 to an estimated \$510 million in 1977. Imports should continue to account for more than 40% of the market during that period.

U.S. suppliers hold the dominant share of Germany's import market for product category components. Imports from the United States were valued at \$51.2 million in 1971 and in 1972 reached \$76 million, a 28% share of the latter year's \$269.6-million import market (see table 2).

The United States is expected to remain the country's primary source of imports as German manufacturers incorporate more advanced design components into their electronic end products. Major

Germany: Consumption of selected groups of electronic components, 1969-77

(in millions of U.S. dollars)



Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

Product Category Definition

Electronic components covered in this survey are basically confined to resistors, capacitors, color TV picture tubes, diodes and rectifiers, transistors, and integrated circuits.

The term "product category" as used in this publication is limited to these six groups of components.

**Germany—Selected Indicators
(1972)**

Gross national product:	\$260 billion
Population:	61 million
Total country imports:	\$40 billion
Imports from U.S. (w/share of total):	\$3 billion (8%)
Total country exports:	\$46 billion
Exports to U.S. (w/share of total):	\$4 billion (9%)
Exchange rate (May 1974):	2.47DM=US\$1

competitors of the United States in the German market for product category components and their respective market shares in 1972 are: France, \$49 million (17%); the Netherlands, \$32 million (12%); and Italy, \$26 million (9%). The United States in 1972 was Germany's leading foreign supplier of resistors, followed by France and the Netherlands. The Netherlands led in capacitor imports. The United States held the largest share of the import market for diodes, rectifiers, and integrated circuits, followed by France. Belgium and Luxembourg were the leading foreign suppliers of imported color TV picture tubes, with the United States a close second. France had a very slight edge over the United States in transistor imports.

Sales Opportunities

Germany's demand for many of the more advanced electronic components outpaces local production. This puts U.S. suppliers in an excellent position to capitalize on the country's growing need for imported components. U.S. components manufacturers are recognized by German users as world leaders in technology and design, and in quality, reliability, and variety of products offered. This unique product capability and applications know-how gives American manufacturers a decided advantage in the German market.

A market research survey recently conducted in Germany for the U.S. Department of Commerce, Office of International Marketing reveals that favorable sales opportunities exist for American exporters of the following electronic components:

Color TV picture tubes.—The market for color TV picture tubes almost tripled between 1971 and 1973, advancing from \$84.9 million to \$230 million. Based on a predicted average annual growth rate of approximately 7%, the market is projected to approach \$275 million in 1977.

Import volume has kept pace with market growth, climbing from \$33 million in 1971 to \$85 million

in 1973. An import level of close to \$95 million is projected for 1977. The U.S. share of imports rose from 12% (\$4.1 million) in 1971 to 24% (\$13.7 million) in 1972.

German consumption of color TV picture tubes has been rising faster than local production in recent years, thus generating an expanding import market. This market should continue to grow because of an anticipated sharp rise in demand for color televisions in the next 5 years. Less than 15% of the approximate 27 million households in Germany had a color TV set in 1972.

German TV receiver manufacturers prefer to use the 110° deflection thin neck tubes almost exclusively for 26-inch screens because of their technological superiority. With demand outstripping domestic production, import prospects are extremely promising.

Capacitors.—The market for capacitors in 1973 was \$192 million, up substantially from the \$110.7 million volume recorded in 1971. The 1977 market for capacitors is projected to approach \$285 million, or almost a 50% increase over the 1973 level.

The outlook for continued expansion of the import market for capacitors is promising. The 1971 import value of \$22.6 million grew to \$47 million in 1973, with a rise to nearly \$70 million predicted for 1977. U.S. manufacturers in 1972 supplied \$5.5 million, or 16% of that year's \$33.6-million import market.

A major factor accounting for the increasing import market for capacitors is the expansion of production of color TV sets. The consequent high demand—particularly for the lower cost electrolytic, foil, and ceramic type capacitors—cannot be met by domestic producers. Computer and industrial equipment manufacturers are also expected to have increased requirements for high quality electrolytic capacitors. A rising demand for chip capacitors will result from the more widespread application of hybrid integrated circuits. Film capacitors also have good sales possibilities.

Resistors.—The market for resistors grew from \$89.7 million in 1971 to \$153.6 million in 1973, with further growth to almost \$175 million predicted for 1977.

Imports totaled \$20.8 million in 1971 and \$38 million in 1973 and are forecast to approach \$45 million in 1977. The United States was the leading foreign supplier in 1972, with a 27% share (\$7.1 million) of the import total.

U.S. manufacturers are Germany's principal source of variable wirewound resistors. Other components with good sales potential are fixed carbon and metal film resistors and thick film networks.

Integrated circuits.—The increasing importance of IC's in almost all sectors of Germany's electronics industry is generating a solid market for these com-

ponents. The market size almost tripled during the 1971-73 period, when it rose from \$53.8 million to \$148 million. The market in 1977 is expected to exceed \$275 million, or 86% over the 1973 figure.

A big boost in imports of IC's occurred during the 1971-73 period, when purchases from abroad increased from \$23.5 million to \$98.8 million. The import market is expected to rise to over \$175 million in 1977. The United States in 1972 was the leading foreign supplier, accounting for \$19.6 million, or 36% of total imports.

IC's with particularly good sales possibilities for U.S. exporters include CMOS/MOS digital IC's, ECL IC's (10K series), MSI bipolar digital IC's, LSI MOS memory IC's, power Darlingtons, D/A and A/D convertors, operational amplifiers, and linear IC's for radios and television receivers.

Manufacturers of electronic data processing equipment in Germany are using new types of IC's such as the ECL 10K type in memories of large and medium-size computers. Semiconductor memories eventually will displace core memories in all types of computers and peripherals. The further development of microprocessors with universal or very specialized functions will lead to an increasing number of IC applications in peripherals, including terminals.

Domestic production of IC's for industrial control and instrumentation is limited. The import potential therefore is high, particularly for CMOS circuits, linear IC's, MOS circuits for D/A and A/D convertors, and single chip digital voltmeter circuits.

TTL and MOS circuits already are being used in telecommunications equipment manufacturing, and a sharp rise in demand for such components is expected in the years just ahead. This will be triggered by the greater use of pulse code modulation (PCM) equipment by the German Post Office (Deutsche Bundespost), the introduction of a new computerized telephone exchange system, production of private electronic telephone systems, and the introduction of pushbutton telephones.

There is a decided trend toward use of integrated circuits in television receivers. Single MOS IC's, for example, are being used increasingly for touch-tuning. Some manufacturers already use a transistorized audio output stage, and all will probably use IC's in this stage as circuits with higher power output become more readily available. Ultrasonic remote control modules, employing MOS IC's, are used in some high quality TV sets.

IC's are not yet used extensively in audio equipment. Demand is expected to increase, especially for monolithic audio output amplifiers of 10 watts or more. Increased demand is expected for CMOS watch and clock circuits, single chip MOS IC's for pocket calculators, and linear IC's for video record-

Germany—The Electronics Industry— Basic Data (1972)

Total value of production:	\$6,300 million
Number of manufacturers:	220
Industry labor force:	343,560
Output of principal electronic components user industries—	
Consumer products industries:	
television sets	\$846 million
radios	\$350 million
watches and clocks	\$230 million
photographic equipment	\$154 million
tape recorders	\$70 million
photocopiers	\$65 million
pocket calculators	\$3 million
Industrial/commercial equipment industries:	
communication and telecommunication equipment	\$1,510 million
computers	\$1,010 million
measuring and testing instruments	\$450 million
industrial equipment	\$420 million
medical electronic equipment	\$170 million

ers and players. Automotive electronics represents a good potential market for a variety of IC's.

Since German production of IC's for military applications is limited, the defense and aerospace sector offers good sales possibilities for U.S. exporters. Almost all IC's used in aerospace equipment are imported from the United States. Demand is highest for IC's for military control systems. Manufacturers of this equipment use linear and digital bipolar IC's and have begun to use MOS RAMS and ROM's. There is also a growing demand for fast (ECL) and low power (CMOS) integrated circuits for military communications equipment.

Diodes and rectifiers.—The market for diodes and rectifiers was \$42.7 million in 1971 and increased to \$90.4 million in 1973. Total purchases in 1977 of such components are projected to approach \$120 million.

Imports expanded from \$27.3 million in 1971 to \$68 million in 1973 and are forecast to approach \$85 million in 1977. The United States, the leading foreign supplier, accounted for 45%, or \$19.9 million, of the 1972 import market.

Zener diodes and fast recovery rectifiers have the highest sales potential in this component group. The market for high power rectifiers is growing with the increase in output of industrial and commercial electronic equipment. Large domestic producers of this equipment manufacture the less sophisticated rectifiers for their own use but depend on outside suppliers for specialized and high performance rectifiers.

Table 1.—Germany: Size of market¹ for selected groups of electronic components 1969-77

(in millions of U.S. dollars)

Description	1969	1971	1972	1973	1974	1977
<i>Resistors</i>						
Production ²	91.1	94.6	118.0	172.0	184.0	196.0
Imports ³	19.9	20.8	26.3	38.0	41.0	44.0
Exports ³	21.8	25.7	35.8	56.4	61.0	66.0
Market size	89.2	89.7	108.5	153.6	164.0	174.0
<i>Capacitors</i>						
Production ²	112.0	121.0	146.5	213.0	239.0	317.0
Imports	22.4	22.6	33.6	47.0	52.4	67.0
Exports	26.0	32.9	46.2	68.0	79.0	100.0
Market size	108.4	110.7	133.9	192.0	212.4	284.0
<i>Color TV picture tubes</i>						
Production ²	38.3	78.0	127.0	213.0	257.0	274.0
Imports	21.4	33.0	56.4	85.0	91.0	92.0
Exports	7.2	26.1	35.7	68.0	88.0	93.2
Market size	52.5	84.9	147.7	230.0	260.0	272.8
<i>Diodes and rectifiers</i>						
Production ²	33.2	42.5	49.7	80.0	96.0	110.8
Imports	23.2	27.3	44.3	68.0	73.6	83.2
Exports	17.0	27.1	40.2	57.6	66.0	75.2
Market size	39.4	42.7	53.8	90.4	103.6	118.8
<i>Transistors</i>						
Production ²	57.2	45.5	59.6	68.0	64.0	51.2
Imports	48.5	42.5	53.8	62.0	56.0	48.0
Exports	23.5	26.0	34.0	42.0	40.0	36.0
Market size	82.2	62.0	79.4	88.0	80.0	63.2
<i>Integrated circuits</i>						
Production ²	10.4	45.2	62.5	109.2	140.0	208.0
Imports	18.6	23.5	55.2	98.8	122.0	176.0
Exports	8.0	14.9	32.5	60.0	76.0	108.0
Market size	21.0	53.8	85.2	148.0	186.0	276.0
<i>Totals</i>						
Production ²	342.2	426.8	563.3	855.2	980.0	1,157.0
Imports	154.0	169.7	269.6	398.8	436.0	510.2
Exports	103.5	152.7	224.4	352.0	410.0	478.4
Market size	392.7	443.8	608.5	902.0	1,006.0	1,188.8

¹ Size of market equals production plus imports minus exports. Parts and accessories not included.

² Production figures do not include components manufactured by OEMs for their own use.

³ Parts and accessories are included, but amount in net imports is negligible.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

Smaller, independent equipment manufacturers also offer good sales opportunities for U.S. suppliers.

Transistors.—The transistor market grew from \$62 million in 1971 to almost \$88 million in 1973. A decline in the annual market to a value of less than \$65 million is expected in 1977, however, as a result of an expected reduction in transistor prices and the increased use of IC's.

Transistor imports increased moderately from \$42.5 million in 1971 to \$62 million in 1973, but they also are expected to decrease, dropping to an estimated level of \$48 million in 1977. The U.S. import market share in 1972 was just over \$10 million, or 19% of the total.

It should be noted, though, that the demand for some special transistors will continue to grow. Good

sales prospects are forecast for fast power transistors for switching applications in power supplies, high voltage power transistors for direct connection to power lines, and power transistors for use in automotive electronic systems. Other transistors with a favorable sales outlook are plastic encapsulated power transistors for use in consumer equipment and R.F. power transistors and complete R.F. modules for transmitters and relaying equipment. U.S. firms are Germany's principal source of supply for R.F. power transistors.

Other electronic components.—Among the types of electronic components outside the product category that offer promising sales opportunities to U.S. exporters are: LED digital displays and lamps, optoelectronic couplers, and photosensors.

The market for gallium compound LED's is expected to show impressive growth, rising from \$5 million in 1972 to an estimated \$12 million in 1977. With improved LED's becoming available at lower prices, electronic end-product manufacturers are finding new applications for LED's, including digital displays and indicator lamps, and optoelectronic couplers. Manufacturers of calculators, measuring and testing instruments, and motor vehicles have the highest demand for LED's. The United States serves as Germany's principal source of LED displays and lamps.

The demand for photosensors, photodiodes and phototransistors is growing because these components are displacing the conventional photocells used in cameras, automatic flash attachments, and industrial photoelectric controls. The market for these devices was over \$4 million in 1972. A 10% average growth rate should lead to an \$8-million market in 1977.

Selected End-User Industries

The total output of Germany's electronics industry is expected to more than double between 1972 and 1977, growing from \$6.3 billion to almost \$13 billion during that period. There are about 220 manufacturers in the industry, which employs some 344,000 people. The industry is particularly strong in production of communications and telecommunications equipment, computers, television sets, measuring and testing instruments, and industrial equipment (see table 3).

The industrial/commercial equipment sector is Germany's largest consumer of electronic components. This sector accounted for 55% of the total 1972 market for electronic components, or approximately \$722 million. Its share of the market may decline as consumption by the consumer products sector increases. The latter sector's 42% share of the 1972 market totaled \$551 million and its forecast 44% share in 1977 will equal roughly \$756 million. The military sector is expected to continue

to account for 3% of the total market, with annual consumption values increasing from about \$39 million in 1972 to over \$50 million in 1977. U.S. subsidiaries and licensees in Germany account for about 28% of the country's total market for electronic components.

Industrial/commercial equipment sector.—Production by the industrial/commercial equipment sector was approximately \$4 billion in 1972 and is expected to increase to almost \$10 billion in 1977. Almost all kinds of electronic components are used within this sector. Integrated circuits and high power, high price semiconductor devices are particularly in demand.

Telecommunications equipment.—The 1972 output by the telecommunications industry was over \$1 billion—the largest registered among industries in the industrial/commercial equipment sector. The industry employs more than 74,000 people and has been expanding at an average annual rate of 28%. Its 1977 output is expected to more than double, rising to over \$2.5 billion.

Almost three-fourths of the industry's equipment output is purchased by the Deutsche Bundespost, the German division of the European Post, Telegraph, and Telephone (PTT) network. Further extension and modernization of the PTT systems and the increasing use of telecommunications equipment in the private sector will provide an impetus for growth in this industry.

The major producers of telecommunications equipment in Germany are Siemens, Telefonbau und Normalzeit, the ITT subsidiary Standard Elektrik Lorenz, AEG—Telefunken, Deutsche Telefon Werke, and the Phillips subsidiary Tekade-FGF GmbH.

Communications equipment.—Radar and navigation aids, radio communications equipment, and public broadcasting equipment account for 8% of the production of the industrial/commercial equipment sector. The 1972 production of such end products amounted to \$300 million, of which almost

Table 2.—Germany: Imports from the United States, and U.S. shares of total imports, of selected groups of electronic components, 1969-72¹

Description	1969		1971		1972	
	Value	U.S. share (percent)	Value	U.S. share (percent)	Value	U.S. share (percent)
Resistors	6.4	32	7.2	34	7.1	27
Capacitors	5.1	23	4.9	22	5.5	16
Color TV picture tubes	2.2	10	4.1	12	13.7	24
Diodes and rectifiers	9.5	41	9.7	36	19.9	45
Transistors	15.2	31	13.3	31	10.2	19
Integrated circuits	7.9	42	12.0	51	19.6	36
Total	46.3	30	51.2	30	76.0	28

¹ Parts and accessories not included.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

90% was accounted for by radio communications and public broadcasting equipment. Production is expected to grow to \$800 million in 1977. About \$62 million, or 21% of the 1972 output was equipment for military use. This proportion is expected to remain stable.

Major producers of communications equipment are AEG-Telefunken, Becker Flugfunkwerk GmbH, Grundig AG, Hellige & Co. (Litton), Sennheiser Electronic, Siemens, Standard Elektrik Lorenz, Tekade-FGF GmbH, and Telefunken Fernseh und Rundfunk GmbH.

Computers and related equipment.—The German computer industry's 1972 production was over \$1 billion, accounting for approximately 25% of the output of the entire industrial/commercial equipment sector. The 1977 production value is forecast at more than \$3 billion, which will represent 35% of the sector's total output.

The computer market in Germany is dominated by U.S. suppliers. Together they hold a 73% share of the total. Siemens is the largest domestic producer, with a 15% market share; it is followed by Nixdorf, Telefunken Computer, Philips-Electrologica, and Kienzle.

The production of minicomputers represents 17% of the total German computer output and is expected to expand. Domestic producers occupy a strong position in this field and compete well in marketing large computers. They face heavy competition from foreign companies, however, in the production of process control computers.

The German computer market is far from saturated. Production growth is expected to accelerate to meet demand despite the government's anti-inflationary policies, which include high interest rates on credit and a special tax on investments. The government is interested in developing a strong national computer industry and provides subsidies to the large producers for research and development. Domestic computer production should also be encouraged by the increasing export possibilities arising from new markets abroad and strengthened by inter-European cooperation in the production of computers.

Siemens, along with France's Compagnie Internationale pour l'Informatique (C.I.I.) and Philips of the Netherlands, announced in July 1973 the formation of Unidata, a holding company designed to better compete with U.S. computer firms by pooling European computer know-how and marketing resources. Siemens produces two of the newer computer models, the 4004/220 and the 4004/230 process control computers, and a nearly complete range of peripherals. It began using semiconductor memories in its CPU's in 1974.

Nixdorf is Germany's largest producer of minicomputers, followed by Kienzle Datensystems KG.

Table 3.—Germany: Output of selected electronic products 1971-72, and projected 1977

(in millions of U.S. dollars)

Product	1971	1972	1977
Communications and telecommunications equipment	1,158	1,510	3,440
Computers	710	1,010	3,040
Color TV sets	384	653	1,360
Measuring and testing instruments	410	450	700
Industrial equipment	384	420	800
Radios	320	350	520
Watches and clocks	206	230	348
Black-and-white TV sets	188	193	120
Medical electronic equipment	152	170	440
Electric cookers	108	166	330
Photographic equipment	137	154	187
Record players	107	128	176
Tape recorders	80	70	64
Photocopiers	56	65	84
Office calculators	36	57	72
Vehicle equipment	10	42	255
Automatic typewriters	5	7	18
Light dimmers	3	5	15
Pocket calculators	—	3	32

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

Nixdorf plans to start production of a new generation of CPU's in 1975. AEG-Telefunken merged the major part of its computer interests with Nixdorf to form a joint company, Telefunken Computer (TC). TC manufactures the large TR 440 computer system, process control computers, and optical character readers. It has also begun to use semiconductor memories.

The Dutch subsidiary, Philips-Electrologica, makes minicomputers, small computers with up to a 1,000-word main memory capacity, and peripherals for these. It began production in 1974 of a new CPU generation with a core memory.

Among U.S. subsidiaries, IBM Deutschland GmbH manufactures the model 370/145, the majority of the 370/125 and system 7 models, and peripheral stores. The Litton subsidiary Triumph-Adler is a successful producer of small computers. NCR assembles medium-size computers and manufactures minicomputers. Honeywell produces disk memories. Univac and Digital Equipment Corporation manufacture special systems.

Siemens and Telefunken Computer produce many of their own components but do utilize outside sources, especially for advanced IC's. IBM Deutschland GmbH produces most of its own components but also purchases a substantial amount, including IC's, from outside suppliers.

Measuring and test instruments.—Germany's 1972 production of measuring and testing instruments was valued at \$450 million and is forecast to climb to \$700 million in 1977. The industry's output ac-

counts for 12% of total production in the industrial/commercial equipment sector. About 45% of its output is exported.

Producers of measuring and testing instruments include Felten & Guillaume Gerätetechnik GmbH, Gossen GmbH, Hartmann & Braun AG, Hellige & Co., Motoco GmbH, Müller & Weigert, Müller and Ziegler, Norddeutsche Mende Rundfunk KG, Siemens AG, VDO Adolf Schindling, and Wandel & Goltermann.

Industrial equipment.—The 1972 production of industrial equipment in Germany was \$420 million. This figure is predicted to reach \$800 million in 1977. Germany has strong capability in the production of semiconductor power converters, electronic controls for machine tools, and current sources for welding. About 40% of the output is exported.

Medical electronic equipment.—Production of medical electronic equipment totaled \$170 million in 1972 and is expected to reach \$440 million in 1977. The 1972 production of medical X-ray equipment alone was over \$90 million. Approximately three-fourths of annual production of this equipment is exported. Slightly under 50% of the output of other therapeutic and diagnostic equipment is exported. Major producers of medical electronic equipment are Fricseke & Hoepfner GmbH, Hartmann & Braun AG, Siemens-Schuckert-Werke AG, and Carl Zeiss.

Consumer products sector.—Output of the principal consumer electronic products was \$2.5 billion in 1972. It is expected to rise at a 12% average annual rate and to reach in excess of \$4 billion in 1977. Underlying this optimistic forecast are anticipated increases in personal income and private consumption.

Television receivers.—Television receiver manufacturing is by far the most important industry in the consumer electronic products sector, accounting for roughly 60% of the sector's total production in 1972. Spurred by increasing German demand for video recorders, the industry's output will continue its rapid expansion through 1977, when it is expected to account for 68% of the consumer product sector's total output.

The output value of color TV sets in 1972 was \$653 million and is expected to more than double to almost \$1.5 billion in 1977, increasing from approximately 1.5 million units to 2.5 million units. About 25% of production is exported. Exports of color TV sets will continue to expand, since their reputation for good quality and advanced design make them very popular in the major West European countries.

The market for portable color TV sets is currently negligible. However, it is expected to reach about 200,000 units in 1977, with German production

meeting slightly more than 50% (approximately 120,000 units) of the domestic demand.

The overall market for black-and-white TV sets is declining. However, the market for black-and-white portable sets is expanding. These sets are being bought increasingly as a second or third set in a household. Portable sets will account for about 40% of the production of black-and-white receivers in 1977. Production of black-and-white sets totaled \$193 million in 1972 and is expected to decrease to \$120 million in 1977. In 1972, 34% of total production was exported, and exports are expected to remain at this level.

Continuing demand for TV receivers both in Germany and abroad has led German TV manufacturers to expand their production capacities. In implementing this expansion, the manufacturers have relied on importing foreign laborers to overcome the domestic labor shortage. However, since possibilities for importing foreign labor probably will be limited in the future, German TV receiver manufacturers are expected to shift more production to countries in which labor is more readily available.

Nearly all German TV receivers are solid state, using an average of 10 IC's per set. Touch-tuning is common, and the controls currently are made primarily with digital TTL circuits. However, MOS IC's will be used more frequently in future models. They already are being used in small ultrasonic remote control units. Thick film integrated circuits are expected to be introduced in the 1974 models and active hybrid IC's in the 1975 models.

Grundig, which claimed a 20% share of the domestic market in 1973, is Germany's largest TV receiver manufacturer. The company has a reputation for making high quality products and is a technical innovator. It was the first company to produce fully solid state color TV sets, modular design, completely electronic touch controls for channel selection, and portable color TV sets in Germany. Other leading producers and their 1972 market shares are: Philips, 17%; Telefunken, 16%; Norddeutsche Mende, 14%; and Blaupunkt, 12%. Blaupunkt produces TV's for Siemens as well as for the open market under its own name. The U.S. subsidiaries in the German TV industry are Schaub Lorenz (ITT), GTE's Saba, and Braun (Gillette Co.); these firms produce about 12% of the total German output of TV receivers.

Philips and Telefunken produce most of their own components, including color TV picture tubes, but they buy custom IC's from outside sources. ITT's subsidiaries, Schaub Lorenz and Standard Elektrik Lorenz, produce some components, including black-and-white and color TV picture tubes. Blaupunkt is a branch of Bosch. It purchases components from Bosch, Siemens, and outside suppliers.

Grundig does not produce any electronic compo-

nents other than a liquid crystal display. The smaller German TV receiver manufacturers—Körting, Loewe Opta, Metz, and Wega—as well as the U.S. subsidiaries, Saba and Braun, do not produce any components. There are no indications that any of these companies plans to start component production in the future.

German production of video recorders and reproducers, though still negligible, appears headed for rapid expansion. Production of video recorders alone is forecast to climb to \$160 million in 1977. Philips holds the patents on the European color video cassette, and several German receiver manufacturers have been licensed to produce cassette recorders. Telefunken recently began production of a video disc player. Philips has displayed prototypes of another disc player that uses a laser for a playback. Production of this type of unit may start in 1975. Wolfgang Bogen, a producer of magnetic recording heads, is investigating the use of a magnetic disc for video recorders.

Radios.—Production of radios, valued at \$350 million in 1972, is forecast to increase to \$520 million in 1977. Hi-Fi stereo receivers are expected to account for the major share of market growth. These units are in increasing demand by domestic consumers, since only 13% of the households in Germany now have them. Their reputation for high quality has also made them popular export products.

Watches and clocks.—Germany is an important watch producer and the largest manufacturer of clocks in the world. Production of these two products combined was \$230 million in 1972 and is predicted to rise to almost \$350 million in 1977. Watch production was 8.3 million units in 1972 and is expected to increase to about 10 million units in 1977. Clock production was over 32 million units in 1972 and may reach 37 million units in 1977.

Pocket calculators.—Although the market for pocket calculators has been dominated by imports from Japan, Germany producers now are beginning to offer products that are price competitive with the Japanese models. As prices decrease further, the mass market is expected to develop rapidly. Production of pocket calculators is predicted to expand substantially from \$3 million (45,000 units) in 1972 to \$32 million (350,000 units) in 1977.

The Competitive Environment

German production of product category components was valued at \$855 million in 1973 and should reach well over \$1 billion in 1977, a 35% increase. Exports are expected to advance from \$352 million in 1973 to approximately \$480 million in 1977. The share of production which is exported is expected to remain around 40% between 1973 and 1977.

Germany's electronic components industry is considered generally strong. Its greatest capability is in

the production of the more conventional components, such as electron tubes, semiconductor power devices, and the standard passive components.

Government subsidies to national companies for component R&D are increasing. They reached \$17.5 million in 1972. Approximately 80% of this went toward the development of more advanced semiconductors.

In spite of high current demand for its products by both domestic and foreign users, Germany's electronic components industry is expanding its production facilities very cautiously. The country's general economic stagnation in 1971 resulted in a decline in consumer demand and consequent overproduction, particularly of passive components. Labor shortages and consequent high wages have also limited expansion of facilities producing semiconductors and other components which require substantial labor input in the production process. This has led to licensing arrangements with companies in lower wage countries and, in general, in a higher reliance on imports.

An estimated 73% of Germany's output of electronic components in 1972 was produced by domestically-owned companies, 12% by U.S. subsidiaries and licensees, and 15% by other foreign companies operating in Germany.

Color TV picture tubes are produced by AEG-Telefunken, the ITT subsidiary Standard Elektrik Lorenz, and the Philips subsidiary Valvo. Each of these producers accounts for about one-third of the total output.

Transistors are manufactured by AEG-Telefunken, ITT-Intermetall, Texas Instruments Deutschland, Siemens, and Valvo. AEG-Telefunken produces a number of power transistors under Motorola license. About 50% of transistor production is accounted for by German-owned companies and 50% by subsidiaries and affiliates of foreign companies.

The major producers of diodes and rectifiers are AEG-Telefunken, Bosch, Brown Boveri, ITT-Intermetall, Semikron, Siemens, and Valvo. Domestically-owned firms account for the greater bulk of production.

Roughly 45% of IC and special semiconductor production is by German-owned companies. Major producers are AEG-Telefunken, Siemens, and Valvo, and the U.S. subsidiaries Fairchild, ITT-Intermetall, National Semiconductor, and Texas Instruments Deutschland. IBM Deutschland also produces these components but only for its own use.

Capacitors are manufactured primarily by domestically-owned companies; only about 15% are produced by foreign subsidiaries. Major manufacturers are AEG-Telefunken, Bosch, CRL Electronic Bauelemente, Frako, Hydrarwerk, Roederstein, Rosenthal, Siemens, Stettner, Valvo, WIMA Wilhelm Westermann, and the U.S. subsidiary ITT Bauelementegruppe Europa.

Two-thirds of the production of resistors is by German owned firms. Important producers are the Philips subsidiary Beyschlag, AEG-Telefunken's CRL Electronic Bauelemente, Deutsche Vitrohm Electronic, ITT Bauelementegruppe Europa, Preh, Resista, Rheinisch-Westfälische Isolatoren-Werke, and Ruf.

Most of the components produced by U.S. subsidiaries and licensees in Germany are sold in the domestic market. However, U.S. companies manufacturing semiconductors and TV picture tubes generally have only one or two production facilities in the whole of Western Europe and therefore export a large part of the output of these components to other European countries. Capacitors, produced mainly by Siemens, are the only group of components in the product category exported in significant quantities to the United States. The value of German-made capacitors exported to the United States in 1972 was almost \$7 million.

U.S. electronic components suppliers operating their own agencies in Germany include Bourns, Erie Electronic, Hewlett-Packard, Litton Precision Products, Mostek, Motorola, and Power Physics. A large number of other U.S. suppliers operate through local sales representatives in Germany.

Import duties.—Duties levied on electronic components imported from the United States range from 7 to 17%. Parts for components are assessed at the same rate as the relevant component. Information on official duty rates applicable to specific products within the product category may be obtained from the U.S. Department of Commerce, Domestic and

International Business Administration, Room 4217, Main Commerce, Washington, D.C. 20230.

In addition to customs duties, the "Umsatzausgleichssteuer" tax must be paid on imported components. This is 11% of the frontier crossing value plus duty and corresponds to the 11% value added tax levied on domestically produced components.

Technical Requirements

The electrical power supply characteristics in Germany are 220/380 volts, 50 hertz, single- or 3-phase, AC.

The metric system of weights and measures is the statutory standard in Germany. International measuring units for electrical values may be used until December 31, 1974, after which time the MKS-AK system will become standard.

Published national standards for electronic components in Germany may be obtained through the American National Standards Institute, Inc., 1430 Broadway, New York, N.Y. 10018.

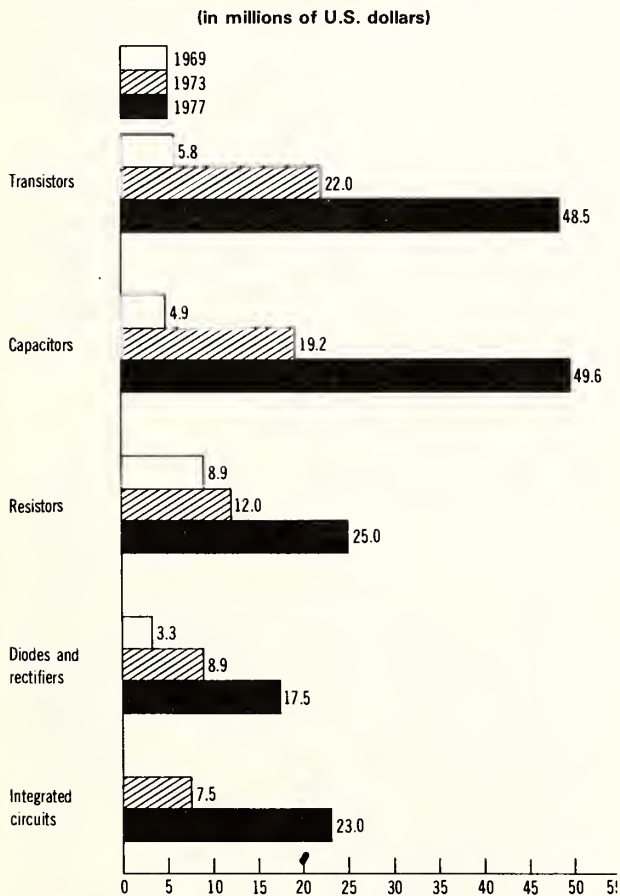
The following market research study, upon which this Country Market Survey is based, is available on loan from the U.S. Department of Commerce, Domestic and International Business Administration, Room 1617M, Main Commerce, Washington, D.C. 20230:

"The Market for Electronic Components in Germany," DIB 74-03-503, November 1973.

Hong Kong

Rapid expansion of Hong Kong's electronics industry has resulted in a substantially increased market for the six selected groups of electronic components covered in this survey. Sales of these components more than doubled during the 1971-73 period, rising from \$32 million to almost \$70 million (see table 1). Trade sources predict that the market will grow at an average annual rate of nearly 25% during the next 4 years. Based on this forecast, sales are expected to approach \$165 million in 1977.

Hong Kong: Size of market for selected groups of electronic components, 1969-77



Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

Manufacturers of finished electronic products in Hong Kong are basically assembly-oriented and depend largely upon foreign sources of supply for components. Imports of the components under review soared from \$27.5 million in 1971 to \$65.2 million in 1973. Increases averaging over 20% annually are expected to bring the level of imports to more than \$145 million in 1977.

American producers of electronic components have expanded their sales volume markedly in Hong Kong during recent years. The Colony's 1972 imports of product category components from the United States rose to \$5.2 million, up 70% over the 1969 level of \$3 million (see table 2). Purchases from U.S. suppliers are expected to at least triple between 1972 and 1977, exceeding \$15 million in the latter year.

The major foreign competitors of the United States in the Hong Kong market for electronic components are Japan, Taiwan, and Singapore.

Sales Opportunities

Increased domestic and foreign investment in the electronics industry, reflecting growing confidence in the Colony's political and economic stability, is

Product Category Definition

Electronic components covered in this survey are basically confined to resistors, capacitors, color TV picture tubes, diodes and rectifiers, transistors, and integrated circuits.

The term "product category" as used in this publication is limited to these six groups of components.

**Hong Kong—Selected Indicators
(1972)**

Gross domestic product:	\$4.06 billion
Population:	4.1 million
Total country imports:	\$3.86 billion
Imports from U.S. (w/share of total):	\$460 million (11.9%)
Total country exports:	\$3.44 billion
Exports to U.S. (w/share of total):	\$1.15 billion (33.5%)
Exchange rate (May 1974):	5.03 Hong Kong dollars=US\$1

the principal factor underlying the favorable outlook for sales of advanced U.S.-made electronic components in Hong Kong.

Demand for all types of components used in radios and calculators, in particular, is expected to rise substantially in the next several years. Production of radios, which presently accounts for 95% of Hong Kong's total output of finished electronic products, is expected to maintain steady growth. Calculator production, which in 1972 accounted for 2% of electronic end-product output, is accelerating rapidly and promises to become a major industry in the years just ahead.

A market research survey recently conducted in Hong Kong for the U.S. Department of Commerce, Office of International Marketing reveals that favorable sales opportunities exist for American exporters of the following electronic components:

Transistors.—Expanding production of solid state radios is expected to boost the Hong Kong market for transistors in 1977 to nearly \$50 million, up from a volume of \$22 million in 1973 and \$9.8 million in 1971.

Imports of transistors, which totaled \$11.6 million in 1971 and \$32 million in 1973, are projected to reach \$65 million in 1977. The U.S. share of the 1972 import market of \$26 million was 11%, or \$2.9 million. Transistors offering the highest sales potential to American manufacturers include:

- Silicon small signal transistors
- Silicon n-p-n power transistors
- Silicon switching/power transistors
- Germanium power transistors

Integrated circuits.—An increase in the production of pocket-size calculators and electronic clocks and watches caused Hong Kong's demand for integrated circuits to soar in recent years. Sales of IC's rose from \$249,000 in 1971 to \$7.5 million in 1973. The market is expected to grow an average of more than 30% a year during the 1973-77 period, reaching \$23 million in the latter year.

Imports of IC's increased from \$194,000 in 1971 to \$5 million in 1973 and are expected to surge to \$17 million in 1977. U.S. suppliers increased their share of the import market from 15% in 1971 to 43% in 1972. Imports of American-made IC's exceeded \$1.1 million in the latter year. Hong Kong's purchases of integrated circuits from the United States are projected to continue rising sharply through the 1970's. Monolithic digital IC's will be in greatest demand in this market during the next few years.

Diodes and rectifiers.—The market for diodes and rectifiers is forecast to rise from \$8.9 million in 1973 to nearly \$18 million in 1977, reflecting an average annual growth rate of more than 18%. Sales totaled \$4.1 million in 1971.

Imports climbed from \$1.9 million in 1971 to \$3 million in 1973, and are projected to reach \$8 million in 1977. The U.S. share of the import market went up from 4% in 1969 to 30% in 1972, reflecting an increase in sales from \$11,000 to \$714,000. U.S. manufacturers will find Hong Kong buyers particularly interested in zener diodes and power rectifiers.

Resistors.—Sales of resistors during the 1971-73 period increased 33%, rising from \$9 million to \$12 million. Continued growth in demand for resistors should boost sales by an average of 20% annually from the 1973 volume to \$25 million in 1977.

Imports of these components increased from \$8.8 million in 1971 to \$11 million in 1973 and are projected to reach \$17 million in 1977. Purchases of U.S.-made resistors in 1972 accounted for \$346,000, or a modest 3% of the \$10.8-million market. Components in this segment of the market expected to offer greatest sales potential in the years ahead are:

- Fixed composition resistors
- Fixed wirewound resistors
- Variable wirewound resistors
- Choke resistors

Capacitors.—Hong Kong's purchases of capacitors more than doubled from \$8.9 million in 1971 to \$19.2 million in 1973. The market is expected to grow at an average annual rate of 27% during the next 4 years, approaching \$50 million in 1977.

Imports increased from \$5 million in 1971 to \$14.2 million in 1973 and are expected to reach nearly \$40 million in 1977. The Colony's imports of capacitors from the United States in 1972 totaled \$166,000. The types of capacitors considered as having the best U.S. export potential include:

- Fixed electrolytic capacitors
- Fixed ceramic capacitors
- Variable capacitors
- Fixed paper and film capacitors

Other electronic components.—Hong Kong's expenditures for electronic components outside the

product category in 1972 included \$25 million for inductors; \$13 million for relays and switches; \$4 million for connectors; \$1 million for various special semiconductor devices, such as light-emitting diodes, photosensors, thermistors, and varistors; \$900,000 for quartz crystals; and \$60,000 for thyristors. Trade sources expect the demand for inductors, relays and switches, connectors, and thyristors to parallel the growth of the radio industry. Sales of LED's and other electronic panel display components also are expected to grow rapidly, in line with increased production of calculators.

Selected End-User Industries

The consumer products sector accounts for virtually all of Hong Kong's output of finished electronic products and is consequently the major user of the electronic components covered in this survey. Sales of product category components to the industrial/commercial equipment sector presently are insignificant.

Since the Hong Kong Government supports the economic policies of free trade and enterprise, there is little interference in industrial and commercial activities. This *laissez-faire* attitude, together with Hong Kong's current political and economic stability, has encouraged a high level of investment, particularly by foreign firms. U.S. companies, with some 500 subsidiaries and over \$500 million in combined assets in Hong Kong, account for the largest bloc of foreign investment in the Colony.

Although the Hong Kong Government does not offer investors special tax exemptions or other incentives to encourage the development of the electronics industry, it does help the industry by financing research activities at Hong Kong's two universities, the University of Hong Kong and the Chinese University of Hong Kong. Research studies are presently being conducted at the University of Hong Kong in ultrasonics; microwave, computer, and control engineering; solid state devices and materials; electronic instrumentation; and applied electrostatics. A small fabrication laboratory has been installed at the Chinese University of Hong Kong, and the properties of semiconductor devices are being examined there.

Consumer products sector.—The number of firms producing consumer electronic products in Hong Kong almost doubled, from 110 to 210, between 1969 and 1973. Employment in the sector increased 24% during the same period, rising from 18,700 to 23,100. Of the total number of factories and the total work force in the sector, almost all are engaged in radio manufacturing. Twenty factories with an aggregate labor force of 3,000 produce other consumer goods, such as calculators and tape recorders.

Hong Kong—The Electronics Industry Basic Data (1972)

Total value of production:	\$346 million (est.)
Number of manufacturers:	300
Industry labor force:	42,000 (est.)
Output of principal electronic components user industries—	
Consumer products industries:	
radio receivers	\$181.1 million
tape recorders/players	\$4.0 million
calculators	\$4.3 million
Industrial/commercial equipment industries:	
communications equipment	\$1.5 million

Total output of consumer electronic products rose 45% from \$130.9 million in 1971 to \$190 million in 1972 (see table 3). In the latter year, radios accounted for approximately 95% of the sector's production; electronic calculators, 2%; and tape recorders, 2%.

The bulk of the sector's output is exported. Exports in 1972 were valued at \$174.2 million, up 42% from the 1971 level of \$123.1 million. Total exports of consumer electronic products are forecast to rise 10 to 20% annually between 1972 and 1977.

The consumer products sector should continue to dominate the finished electronic products industry, accounting for over 90% of total production in the foreseeable future.

Radios.—The radio manufacturing industry comprises some 190 factories, with total employment exceeding 20,000. The industry's annual output increased from approximately \$129 million (29 million radios) in 1971 to \$181 million (39 million radios) in 1972. This represented a 40% increase in value.

Hong Kong's radio industry is highly fragmented, with no single firm contributing more than 7% of total radio output. Ten firms, each employing 900 to 2,000 persons, control approximately 50% of production. These include Atlas Electronics Corp., Ltd.; Sanyo Electric, Ltd.; Asia International Electronics, Ltd.; Herald Electronics, Ltd.; and Realtone Electronics, Ltd.

The remaining five firms are subsidiaries of American companies. These are: Arvin—Hong Kong, Ltd. (Arvin Corp.); Sylvania—Far East, Ltd. (GTE International); Electronic Industry, Ltd. (General Electric Co.); Transelectronics, Ltd. (ITT); and TransWorld Electronics, Ltd. (Amerex Trading Corp.). Other U.S.-owned firms manufacturing radios in Hong Kong include Kendy Enterprise, Ltd., and

Table 1.—Hong Kong: Size of market¹ for selected groups of electronic components, 1969-77

(in thousands of U.S. dollars)

Description	1969	1971	1972	1973	1974	1977
<i>Resistors</i>						
Production ²	500	1,000	2,200	3,000	4,000	12,000
Imports	9,000	8,754	10,792	11,000	13,000	17,000
Exports	600	800	1,158	2,000	2,500	4,000
Market size	8,900	8,954	11,834	12,000	14,500	25,000
<i>Capacitors</i>						
Production ²	3,500	5,845	6,200	9,500	13,000	24,000
Imports	2,639	5,022	8,635	14,248	21,400	39,000
Exports	1,199	2,003	3,030	4,500	6,200	13,400
Market size	4,940	8,864	11,805	19,248	28,200	49,600
<i>Color TV picture tubes</i>						
Production ²	—	—	—	—	—	—
Imports	2	18	20	10	10	12
Exports	—	—	—	—	—	—
Market size	2	18	20	10	10	12
<i>Diodes and rectifiers</i>						
Production ²	3,000	8,500	13,000	18,000	25,000	48,000
Imports	309	1,928	2,364	2,955	3,800	8,000
Exports	—	6,286	8,746	12,077	16,900	38,500
Market size	3,309	4,142	6,618	8,878	11,900	17,000
<i>Transistors</i>						
Production ²	32,135	30,000	35,000	45,000	48,000	113,500
Imports	12,865	11,592	26,016	32,000	38,000	65,000
Exports	39,150	31,814	44,632	55,000	61,000	130,000
Market size	5,850	9,778	16,384	22,000	25,000	48,500
<i>Integrated circuits</i>						
Production ²	—	900	10,000	22,000	30,000	50,000
Imports	—	194	2,536	5,000	8,000	17,000
Exports	—	845	9,065	19,500	26,000	44,000
Market size	—	249	3,471	7,500	12,000	23,000
<i>Totals</i>						
Production ²	39,135	46,245	66,400	97,500	120,000	247,500
Imports	24,815	27,508	50,363	65,213	84,210	146,012
Exports	40,949	41,748	66,631	93,077	112,600	229,900
Market size	23,001	32,005	50,132	69,636	91,610	163,612

¹ Size of market equals production plus imports minus exports. Parts and accessories not included.

² Production figures do not include components manufactured by OEM's for their own use, with the exception of capacitors. In-house production of capacitors represents no more than 5% of the total.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

Minerva Industries, Ltd. U.S. subsidiaries in Hong Kong accounted for 18 to 22% of the Colony's purchases of product category components in 1972.

The bulk of radio production consists of 5- to 10-transistor models and, in some cases, 20-transistor models, all low-cost, high volume items. In the past, Hong Kong businessmen have invested as little capital as possible and have looked for a quick return on investments. Now, however, with the economic and political stability of the Government seemingly assured, businessmen are more willing to make substantial long-term investments. As a result, the output of the entire radio industry gradually is being expanded, upgraded, and diversified.

The radio industry's greatest obstacle to growth is the shortage of materials, especially plastics. Prices of materials have soared and, in some cases, cannot be met by manufacturers, particularly the smaller

ones who often rely on credit. The extent to which the industry will be affected by these shortages is not yet known.

A few of the larger radio manufacturers in Hong Kong produce components or have injection-molding facilities. Atlas Electronics Corporation, Ltd., for example, makes such components as transistors, polyvaricon tuning condensers, IF transformers, oscillator coils, electrolytic capacitors, input and output power transformers, and ferrite bars. Most of the factories, however, are dependent on outside sources for their electronic components requirements.

Hong Kong radio manufacturers traditionally signed long-term contracts with the Japanese, their chief suppliers of electronic components, so as to ensure steady deliveries. However, the increasing prices of Japanese products are compelling Hong

Kong buyers to look for other sources of supply. This could result in excellent export opportunities for U.S. firms.

Calculators.—The production of electronic calculators in Hong Kong is growing rapidly and should become a major industry during the next 5 years. The number of calculators produced rose sharply from 1,000 units valued at \$162,000 in 1971 to 69,000 units worth \$4.2 million in 1972. Output in 1973 was estimated at about 300,000 units valued at \$12 million. This rapid rate of growth is expected to continue as the Colony's electronics manufacturers, particularly radio producers, diversify their present operations to meet the demand for calculators.

The Hong Kong-owned Kam Cheung Brothers Electronics Co., Ltd., for example, plans to invest over \$500,000 for expansion of its present plant facilities to provide for the manufacture of electronic calculators. With its increased production capabilities, the firm's work force, presently numbering 140, should double in size. The Kam Cheung Brothers now make radio receiving equipment and office machines.

Industrial/commercial equipment sector.—Some 400 workers in three factories are engaged in manufacturing industrial/commercial electronic equipment in Hong Kong. The sector's total output in 1972 amounted to only \$1.5 million, or less than 1% of the Colony's total production of finished electronic products. Major products manufactured by firms in this sector are radio transmitter/receivers, line telephone and telegraph equipment, and commercial radio and radar equipment.

Modest growth is expected in this sector. Trade estimates place 1977 output at roughly \$3 million. Hong Kong firms tend to be reluctant to invest in the sophisticated equipment and technology required for industrial/commercial electronic equipment production.

Radio transmitter/receivers.—Output of radio

transmitter/receivers in 1972 amounted to 233,000 units valued at \$893,000. From 100 to 150 employees are engaged in the manufacture of these products. The leading companies in this industry, each of whom accounts for 33% of the total output, are the Edison Electronic Co., Ltd.; The Hing Yip Electronic Co., Ltd.; and the Hong Kong Electronic Corporation. These three firms are involved primarily in assembly operations and purchase all their parts and components requirements from outside suppliers.

The Competitive Environment

Hong Kong's domestic production of electronic components within the product category totaled \$97.5 million in 1973 and is projected to approach \$250 million in 1977, representing an average annual growth rate of 26%. Exports are forecast to rise from \$93 million in 1973 to \$230 million in 1977.

Of the 50 major components manufacturers in Hong Kong, 16 are subsidiaries or affiliates of American firms and 4 are owned by other foreign companies. Subsidiaries of U.S. firms account for most of the employment and more than 75% of the total output. The remaining components manufacturers are locally owned and have fewer than 400 workers.

The nine leading producers of semiconductors and integrated circuits include Teledyne Semiconductors; Semiconductor Devices, Ltd.; Motorola Semiconductors—Hong Kong, Ltd.; Carter Semiconductor, Ltd.; Century Electronic, Ltd.; Electronic Devices, Ltd.; Fairchild Semiconductor, Ltd.; Ledel Semiconductor, Ltd.; and Micro Electronics, Ltd. Century Electronic and Semiconductor Devices are the only Hong Kong-owned firms. Electronic Devices is a subsidiary of the Dutch firm N. V. Philips, and the others are subsidiaries of American companies. Fairchild, with about 3,000 employees, is the largest of these manufacturers.

Table 2.—Hong Kong: Imports from the United States, and U.S. share of total imports, of selected groups of electronic components, 1969-72^a

(in thousands of U.S. dollars)

Description	1969		1971		1972	
	Value	U.S. share (percent)	Value	U.S. share (percent)	Value	U.S. share (percent)
Resistors	—	—	92	1	346	3
Capacitors	84	3	44	1	166	2
Color TV picture tubes	—	—	—	—	8	40
Diodes and rectifiers	11	4	148	8	714	30
Transistors	2,959	23	2,260	19	2,865	11
Integrated circuits	—	—	30	15	1,102	43
Total	3,054	12	2,574	9	5,201	10

^a Parts and accessories not included.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

The 10 major producers of computer memories and related electronic components are Fibri-Tek—Hong Kong Ltd.; Electronic Memories and Magnetics, Ltd.; Lockheed Aircraft International Ltd.; Data Recall—Hong Kong, Ltd.; Data Magnetics—Hong Kong, Ltd.; Core Memories—Hong Kong, Ltd.; Ampex Ferrotec, Ltd.; Waltek, Ltd.; DSI—Hong Kong, Ltd.; and The National Cash Register Company, Ltd. The two largest firms are American-owned. They are Ampex Ferrotec, with about 3,000 employees, and Fabri-Tek, with about 1,000.

U.S. subsidiaries in Hong Kong ship from 75 to 95% of the components they manufacture to the United States, and about 10% is sold on the local market. From 1 to 7% is shipped to Taiwan, Singapore, Japan, and South Korea. However, even the bulk of these components are first sent to the United States for final testing and approval and then returned to Hong Kong for sale.

American companies actively exporting electronic components to Hong Kong include Globe-Union, Inc.; Texas Instruments; Litronix, Inc.; General Instruments, Inc.; RCA Corporation; Sprague Electric Co.; Duluth Scientific, Inc.; and Monsanto, Inc. Other important foreign suppliers are the Japanese companies Mitsumi Electric Co., Ltd.; Hitachi, Ltd.; and Sony Corporation. The Dutch firm N.V. Philips and the German firm Siemens AG also sell components to Hong Kong.

Prospects are excellent for increased sales in Hong Kong by American electronic components manufacturers in view of the present price competitiveness of U.S.-origin components vis-a-vis Japanese and other foreign-made products. Another major factor favoring greater market penetration by U.S. producers is the Colony's growing production of more sophisticated electronic end-products. American industry, the world's leading supplier of advanced components, should benefit from this trend.

Trade sources report that U.S. exporters could increase their sales in the Colony by providing comprehensive customer service, especially applications assistance. Hong Kong manufacturers also would welcome engineering and technical assistance in their changeover to production of more sophisticated electronic products.

Buyers are especially interested in shortening delivery times for supplies and in cutting freight costs

Table 3.—Hong Kong: Estimated production of consumer electronic products, 1971 and 1972

	1971		1972	
	Quantity	Value	Quantity	Value
Radios	28,661	129,192	38,944	181,136
Calculators	1	162	69	4,263
Tape recorders/ players	72	1,032	282	3,967
Microphones, loud- speakers, and amplifiers	257	174	457	638
TV receivers	8	346	1	39
Totals	—	130,906	—	190,043

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

on small orders. Deliveries from the United States now take from 1 to 2 months by sea and from 1 to 2 weeks by air, while shipments from Japan take less than half that time. A number of U.S. suppliers are now stocking components with quick turnover in Hong Kong to offset delivery disadvantages.

Import duties—Hong Kong is a free port; there are no customs duties, taxes, or other nontariff barriers applied to the importation of electronic components.

Technical Requirements

The electrical power supply characteristics in Hong Kong are 200 volts, 50 hertz for normal use and 346 volts, 50 hertz for industrial use.

Both the English and the metric systems of weights and measures are used in the Colony, but the metric system is becoming more widely accepted.

Published national standards for electronic components in Hong Kong may be obtained through the American National Standards Institute, Inc., 1430 Broadway, New York, N.Y. 10018.

The following market research study, upon which this Country Market Survey is based, is available on loan from the U.S. Department of Commerce, Domestic and International Business Administration, Room 1617M, Main Commerce, Washington, D.C. 20230:

"The Market for Electronic Components in Hong Kong." DIB 74-05-505, November 1973.

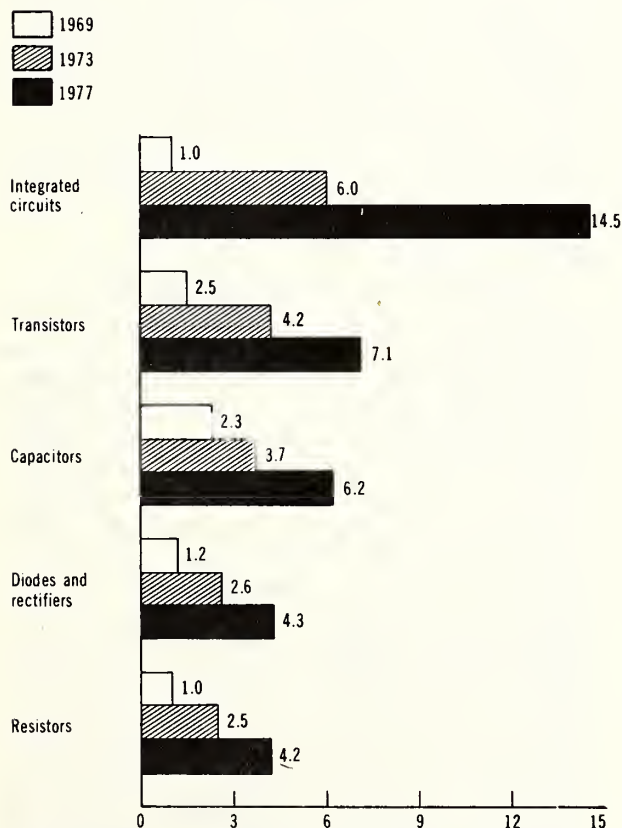
Israel

Israel's success in selling electronic end products in the world market and its strong domestic demand for military communications equipment are the leading factors behind predicted sharp increases in the country's purchases of electronic components during the years just ahead.

An expected 18% average annual growth rate suggests a 1977 Israeli market of more than \$36 million for the selected groups of electronic components covered in this survey.

Israel: Size of market for selected groups of electronic components, 1969-77

(in millions of U.S. dollars)



Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

This would be nearly double the 1973 level of \$18.9 million (see table 1). Similarly sharp increases in purchases of these components took place in the 1969-72 period, when sales climbed from \$8 million to \$16.1 million.

The Israeli electronics industry imports approximately 90% of its electronic component requirements since domestic producers cannot supply the full range of components at competitive world prices. The industry has abandoned any attempt to achieve complete self-sufficiency in production of basic electronic components, realizing that its competitive advantage lies in the production of electronic systems and subsystems with high value-added factors. Imports of product category components, therefore, are expected to keep pace with the growth rate predicted for the market as a whole. The import market should approach \$33 million in 1977, as compared with \$16.6 million in 1973.

The vital role played by American electronics firms as investors, licensors, and technological advisors to Israeli electronics manufacturers seems likely to assure that the United States will remain the country's principal foreign supplier of electronic components. Purchases by U.S. subsidiaries and

Product Category Definition

Electronic components covered in this survey are basically confined to resistors, capacitors, color TV picture tubes, diodes and rectifiers, transistors, and integrated circuits.

The term "product category" as used in this publication is limited to these six groups of components.

**Israel—Selected Indicators
(1972)**

Gross national product:	\$6.9 billion
Population:	3.15 million
Total country imports:	\$1,921 million
Imports from U.S. (w/share of total):	\$368 million (18.7%)
Total country exports:	\$1,147 million
Exports to U.S. (w/share of total):	\$223 million (19.5%)
Exchange rate (May 1974):	4.19 Israeli pounds =US\$1

licensees are estimated to account for 65% of Israel's imports of product category components.

Imports from the United States climbed from about \$4.5 million in 1969 to nearly \$8.2 million in 1972 (see table 2). If, as expected, U.S. suppliers retain their 1972 share (57%) of the annual import market, imports from the United States should exceed \$18.5 million in 1977.

As significant quantities of American-made/designed components supplied from European central warehousing depots or European manufacturing facilities of U.S. companies appear in Israeli statistics as imports from third countries, the share of the country's import market held by U.S. suppliers is substantially higher than these figures indicate.

Sales Opportunities

U.S. manufacturers of electronic components are in an excellent position to capitalize on Israel's drive to expand its electronics industry through the application of new technologies. They are recognized by Israeli electronic engineers, many of whom studied in the United States, as world leaders in technology and design, and in quality, reliability, and variety of products offered.

A market research survey recently conducted in Israel for the U.S. Department of Commerce, Office of International Marketing reveals that favorable sales opportunities exist for American exporters of the following electronic components:

Integrated circuits.—Israeli purchases of IC's are forecast to surge from \$6 million in 1973 to \$14.5 million in 1977. The 25% average annual growth represented by this increase in consumption exceeds by far the 14% average annual rise predicted for sales of all other product category components.

The buoyancy in demand for IC's became obvious during the 1971-73 period, when sales jumped from \$3.8 million to \$6 million. Israel's effort to improve the competitive position of its electronics

industry in world markets is largely responsible for the dramatic rise in the country's consumption of IC's.

American exporters should be the chief beneficiaries of the rapidly expanding Israeli market for integrated circuits. Israel imports 90% of its total IC requirements, and 70% of the imports are of U.S. origin. Computer firms are expected to offer the most attractive sales opportunities to U.S. suppliers of IC's by virtue of their plans to expand and diversify their production of minicomputers and computer peripherals. These plans received new impetus when a controlling interest in the leading manufacturer, Elbit Computers, Ltd., was acquired by Control Data Corporation of Minneapolis.

Although many Israeli electronics manufacturers have designed their own circuitry, they rely mainly on foreign sources of supply to meet their IC requirements. U.S. exporters will find that COS/MOS digital, MSI bipolar digital, and linear IC's offer the greatest sales potential.

Transistors.—The market for transistors amounted to \$4.2 million in 1973, which was well above the 1971 level of \$3.6 million. Transistor sales are projected to total \$7 million in 1977, of which \$6 million probably will be imported from the United States and from European-based manufacturing subsidiaries of U.S. firms in a roughly 50/50 ratio. Although the average annual growth rate for this segment of the market—projected at 14% during the 1973-77 period—will eventually be slowed by increased use of IC's and the leveling off of TV receiver production, all types of transistors are expected to be in high demand throughout the 1970's. U.S. exporters should have particular success in selling silicon and microwave transistors.

Capacitors.—While Israel manufactures substantial quantities of certain types of capacitors, the bulk of this production is exported. About 80% of the country's requirements for these devices are satisfied through imports, which, in 1972, totaled \$2.5 million. Nearly \$1.3 million of these imports were of U.S. origin. Sales of capacitors are expected to rise from \$3.7 million in 1973 to \$6.2 million in 1977, with imports climbing to almost \$5 million in the latter year. Israeli buyers are particularly interested in ceramic and fixed electrolytic capacitors.

Diodes and rectifiers.—The outlook for 1977 suggests that consumption of diodes and rectifiers will reach \$4.3 million, up from \$2.6 million in 1973 and \$1.8 million in 1971. Since there is no local production of these components, Israeli users rely on imports to fill their needs and are likely to continue to do so for the foreseeable future. U.S. firms held an estimated 60% of the market during the 1969-72 period. European manufacturers ac-

counted for the balance, which consisted mainly of diodes and rectifiers used in the manufacture of telephone exchanges. Market analysts report strong buyer interest in silicon diodes, zener diodes, and power rectifiers.

Resistors.—Electronic equipment makers import approximately 95% of their requirements for resistors, since Israeli production of resistors is limited primarily to high-cost precision types little used by domestic industry. Imports amounted to slightly more than \$2 million in 1972, of which 37% represented sales by American firms. Imports are projected to reach \$3.8 million in 1977. Israel's consumption of resistors in that year is expected to total \$4.2 million, a substantial rise over 1973's total market of \$2.5 million and almost 250% above the 1971 level of \$1.7 million. Sales prospects are brightest for fixed composition and fixed film resistors.

Other electronic components.—Israel's expenditures for electronic components outside the product category in 1972 included \$3 million for connectors, the bulk of which were imported from the United States. Growth in this segment of the market is expected to average 14% per year between 1973 and 1977. U.S. exporters will find opportunities to sell rack and panel connectors, circular connectors, coaxial connectors, and printed circuit connectors.

The United States is a regular supplier to Israel of electron tubes for use in industrial and military equipment. The market for these tubes is expected to average \$2.5 million annually through 1977. The sales potential is highest for diode rectifiers, thyatrons, HP transmitting tubes, microwave tubes, and industrial and military receiving tubes.

Selected End-User Industries

The urgent needs of Israel's defense establishment sparked the development of an electronics industry that has gone far beyond its original goal of increasing the country's military self-sufficiency. The industry has become a vital source of foreign exchange and an employer of 12,000 people. Utilizing their Nation's ample reservoir of low-cost engineering talent, Israel's 65 electronics manufacturers have steadily diversified their output to include civilian telecommunications systems, computers and computer peripherals, medical and scientific instrumentation, and industrial process control systems. The industry's output rose from a modest \$3 million in 1961 to a substantial \$157 million in 1972. According to the *Plan for the Development of Industry in Israel, 1971-1976-1981*, published in November 1972 by the Ministry of Commerce and Industry, production should reach \$300 million in 1977.

The outbreak of war in the Middle East in October 1973, while redirecting manufacturers' atten-

Israel—The Electronics Industry Basic Data (1972)

Total value of production:	\$157 million
Number of manufacturers:	65
Industry labor force:	12,000
Output of principal electronic components user industries—	
Consumer products industries (est.):	\$20.2 million
Industrial/commercial equipment industries (including military telecommunications equipment industry):	\$117.1 million

tion to the military sector of the market, is expected to slow the industry's growth only temporarily, if at all. Government economists tend to maintain their original view that annual increases in production will average 13.5% between 1973 and 1978 and 15% thereafter. Exports may be hampered, however, because so little military equipment will be available for sale abroad. Israel's total exports of electronic finished products and components, estimated at \$50 million in 1972, had been expected to rise by an average of at least 20% per year through 1978.

The Israeli Government plays an important role in determining the course of the country's industrial development, attracting foreign and domestic capital with low-cost loans and direct cash grants and boosting the profit margins of eligible enterprises through preferential tax treatment. Recipients of these benefits are selected according to a variety of criteria, including their potential contribution to the defense effort, probable success in exporting their products or reducing Israeli dependence on imports, ability to help absorb the flow of immigrants, and willingness to locate in one of Israel's underpopulated "development zones." Additional incentives improve the ability of Israeli exporters to compete with the larger industrial countries in world markets. These incentives include subsidies, such as rebates of indirect taxes approximating 20% of the value-added; refund of customs duties and purchase taxes on materials used to produce exported goods; favorable export financing and assistance with certain transportation costs; and loans and grants of funds for export promotion. Measures such as these, covering almost every aspect of corporate finance, have been a major factor in stimulating the rapid growth of the entire electronics industry.

With an eye to the industry's future, the Government actively fosters research and development in the field of electronics as it does in other areas. Specific projects—usually defense-related—are conducted in Government-owned plants, and grants are made to private enterprises on a matching funds

Table 1.—Israel: Size of market ¹ for selected groups of electronic components, 1969-77
(in thousands of U.S. dollars)

Description	1969	1971	1972	1973	1974	1977
<i>Resistors</i>						
Production	40	730	2,205	3,300	4,300	9,400
Imports	1,032	1,644	2,042	2,300	2,600	3,750
Exports	30	689	2,100	3,150	4,100	9,000
Market size	1,042	1,685	2,147	2,450	2,800	4,150
<i>Capacitors</i>						
Production	1,400	1,500	2,300	2,650	3,150	5,200
Imports	1,775	2,492	2,480	2,900	3,250	4,850
Exports	830	898	1,575	1,900	2,250	3,900
Market size	2,345	3,094	3,205	3,650	4,150	6,150
<i>Color TV picture tubes</i>						
Production	—	—	—	—	—	—
Imports	—	—	—	—	450	975
Exports	—	—	—	—	450	975
Market size	—	—	—	—	—	—
<i>Diodes and rectifiers</i>						
Production	—	—	—	—	—	—
Imports	1,150	1,850	2,250	2,550	2,900	4,300
Exports	—	—	—	—	—	—
Market size	1,150	1,850	2,250	2,550	2,900	4,300
<i>Transistors</i>						
Production ²	500	805	650	950	1,150	1,950
Imports	2,157	3,039	3,222	3,540	4,020	5,960
Exports	150	240	190	290	370	810
Market size	2,507	3,604	3,682	4,200	4,800	7,100
<i>Integrated circuits</i>						
Production ²	380	600	500	700	875	1,700
Imports	620	3,200	4,300	5,300	6,625	12,800
Exports	—	—	—	—	—	—
Market size	1,000	3,800	4,800	6,000	7,500	14,500
<i>Totals</i>						
Production	2,320	3,635	5,655	7,600	9,475	18,250
Imports	6,734	12,225	14,294	16,590	19,845	32,635
Exports	1,010	1,827	3,865	5,340	7,170	14,685
Market size	8,044	14,033	16,084	18,850	22,150	36,200

¹ Size of market equals production plus imports minus exports. Parts and accessories not included.

² Production figures for 1969-73 include components manufactured by OEM's for their own use. In-house production of transistors represents 50% of the total and that of integrated circuits, 60%.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

basis for development of products deemed likely to be commercially successful. Grants to the electronics industry have grown sharply in recent years, rising from \$2.5 million in 1970 to \$3.6 million in 1971 and \$4.5 million in 1972.

The availability of low-cost manpower, particularly engineers and skilled factory workers, is of enormous assistance to Israel in its drive to expand electronics industry output to assure a rising flow of exports. An increase in the number of university students opting for engineering careers and the arrival of skilled immigrants from abroad have overcome the shortage of engineers that developed during the industry's early years. The supply of unskilled labor is being augmented by increasing numbers of women entering the labor force and by an influx of workers from the occupied territories.

Industrial/commercial equipment sector.—The industrial/commercial equipment sector of Israel's electronics industry is rapidly increasing in importance as a market for electronic components. Predictions made just prior to the outbreak of war in October 1973 indicated that this sector would play a much larger role than the military equipment sector in the 13.5% average annual growth forecast for the industry as a whole between 1971 and 1978.

Leading manufacturers—all of which formerly made electronic equipment exclusively for the Israeli military establishment and a few foreign customers—have stepped up their efforts to add exportable industrial and commercial equipment to their product lines. Most of the \$61.9 million in capital investment suggested by Government planners as being appropriate for the electronics industry during

the 1972-76 period is likely to be earmarked for the development and further expansion of nonmilitary production.

The industrial/commercial equipment sector is composed of approximately 40 firms employing an estimated total of 7,000 persons. Production, including that of military communications equipment, amounted to \$117.1 million in 1972, compared with \$81.2 million in 1970.¹ The great bulk of this production, in fact 80% of the output of the entire electronics industry, is accounted for by six corporations: Elron Electronics Industries, Ltd.; Elta Electronics Industries, Ltd.; MBT (Plant B, Israel Aircraft Industries, Ltd.); Motorola Israel, Ltd.; Tadiran Israel Electronics Industries, Ltd.; and Telrad Telecommunication and Electronic Industries, Ltd.

Communications equipment.—The communications equipment subsector is the core of the Israeli electronics industry and the key to its growth during the next several years. The 10 firms engaged in the manufacture of civilian and military communications equipment employ the majority of the electronic industry's workforce and account for a major share of its production. Trade sources estimate that output of military communications equipment, including such items as manpack, vehicular, and airborne radios; single side-band radios; mobile, base, and walkie-talkie two-way radios; and radar equipment (S-band and position indicators) totaled \$30 million in 1972. Production of main and private branch telephone exchange equipment, estimated at \$14 million for 1972, jumped to \$24 million in 1973. Israeli firms in this subsector also make data transmission equipment (data and other modems, including FSK) and antenna systems.

The United States has provided the technological basis for Israel's manufacture of military communications equipment. However, most of the license agreements covering production of civilian telecom-

munications equipment are with European companies, including DEL Telecommunications of France; Hasler AG, Standard Telefon and Radio, Gfeller S.A., Schprecer & Schuh, and Albiswerk Zurich of Switzerland; AEI, ATE, GEC, and Key-switch of the United Kingdom; and the ITT subsidiary Standard Elektrik Lorenz AG of Germany.

Israel's largest and most diversified electronics firm and a leading manufacturer of communications equipment is Tadiran Israel Electronics Industries, Ltd. Tadiran, which reported sales of \$65 million in 1972, is a joint venture between the U.S. firm, GTE International, Inc. and Israel's giant Koor Industries and the Israeli Ministry of Defense. The company employs 3,500 persons, more than any other firm in the industry.

Tadiran's line of military communications equipment consists of such products as field tactical radio equipment, field radio relays and multiplexers, communications centrals, and field telephone equipment. Its production is based on technology obtained primarily from U.S. firms, including Sylvania Electric Products, Magnavox, and Lenkurt Electric. Civilian PMBX's, PABX's, communications and central systems, and carrier equipment are produced under license from GTE and Superior Continental Corporation of the United States. Tadiran's share of the 1973 domestic telecommunications market, as allocated by the Ministry of Communications, was 35% for public main exchanges and 50% for PABX's.

Telrad Telecommunications and Electronic Industries, Ltd., and its subsidiary, Keren Electronica, Ltd., had the major share of the 1973 domestic market for civilian telecommunications equipment: 60% of the public main exchanges, 100% of the Stroeger main exchanges, 40% of the PABX's, and 98% of the telephone instruments. Telrad, which has licensing agreements with European subsidiaries of ITT, reported 1972 sales of \$16 million.

Elta Electronics Industries, Ltd., a subsidiary of the Government-owned Israel Aircraft Industries,

¹ Expressed in terms of 1972 prices.

Table 2.—Israel: Imports from the United States, and U.S. share of total imports, of selected groups of electronic components, 1969-72¹

(in thousands of U.S. dollars)

Description	1969		1971		1972	
	Value	U.S. share (percent)	Value	U.S. share (percent)	Value	U.S. share (percent)
Resistors	491	47.6	752	45.7	756	37.0
Capacitors	1,196	67.4	1,477	59.3	1,258	50.7
Color TV picture tubes	—	—	—	—	—	—
Diodes and rectifiers	690	60.0	1,110	60.0	1,350	60.0
Transistors	1,655	76.7	2,005	66.0	1,787	55.5
Integrated circuits	434	70.0	2,240	70.0	3,010	70.0
Total	4,466	66.3	7,584	62.0	8,161	57.1

¹ Parts and accessories not included.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

Ltd., and the third member of Israel's "big three" in electronics, reported sales of \$14.5 million in 1972. Almost all of its production is defense-oriented and includes aviation communications equipment and systems, radar systems, and portable vehicle-mounted naval and airborne transceivers. UHF communications equipment is produced under license from the American firm, Admiral Corporation. Elta recently expanded its activities to include the manufacture of medical electronic equipment and industrial control systems.

The communications division of Motorola Israel, Ltd., a subsidiary of the U.S. firm, makes two-way and other communications equipment and systems, portable mobile and base stations, paging systems, and data modems. The company's total sales for 1972 were estimated at \$14 million. Motorola's exports of radio communications equipment to developing countries, especially African nations, have been a major factor in the emergence of Israel as an exporter of electronic equipment.

American Electronics Laboratories (Israel), Ltd. (AEL), a subsidiary of the U.S. firm, makes VHF/UHF power amplifiers, wide-band FM broadcast power amplifiers, fixed and mobile communication centers, telephone exchanges, and custom-designed microwave communications systems for military use. AEL is pioneering in the manufacture of semielectronic switchboards under license from Albiswerk Zurich of Switzerland. The company's annual sales approximate \$5 million.

The future prosperity and expansion plans of the telecommunications equipment subsector, and indeed of the Israeli electronics industry as a whole, depend entirely on its ability to turn out the kind of products for which there is strong demand in foreign markets. Electronics manufacturers have long realized that Israel's own needs for military and civilian communications equipment form too narrow a base on which to build their future. Trade analysts expect that the importance of military equipment in Israeli exports of electronic end products will decline as the industry further develops its line of data transmission and other sophisticated telecommunications equipment. The industry has been keeping fairly well abreast of the state of the art in electronics; thus, there should be little delay in incorporating recent technological advances such as MOS and LSI circuitry.

Consumer products sector.—The consumer electronic products sector is of relatively minor importance in the Israeli market for electronic components, accounting for only about 5% of the total. Within the context of Israel's political and economic struggle for survival, the demand for consumer goods has had to give way to more pressing economic priorities. A prime example of this factor, as it af-

fects the electronics industry, has been the Government's repeated postponement of the inauguration of color TV broadcasting.

Output of consumer electronic products—monochrome TV sets, car radios, and an insignificant quantity of intercoms and stereo phonograph systems—totaled about \$20 million in 1972. Market analysts predicted in mid-1973 that annual production would approach \$30 million in 1977. This would reflect an average annual growth rate of 8.5% for the sector, well below the 13.5% forecast for the electronics industry as a whole. The events of October 1973 could dictate a downward revision of this figure, however, since manufacturers may be hard pressed to maintain production of industrial and commercial equipment for export—much less continue making consumer products—while at the same time struggling to fill military orders.

Television receivers.—The manufacture of monochrome TV sets accounts for approximately 90% of total consumer electronic products output and occupies the great majority of the sector's 2,000 employees. Production, however, is on the decline. A total of 55,336 sets were assembled in 1972, compared with 68,877 in 1971, the TV receiver industry's peak year. Not only is the market approaching the saturation point (68% of Israeli families now own a TV set), but many who would like to buy their first set or replace an old set are awaiting the arrival of color TV broadcasting. The trend toward the purchase of a second TV set is not likely to give the domestic industry much of a boost, since most second sets are portables and all portable sets are imported.

The TV receiver industry does not intend to expand its plant facilities or its output, pending the introduction of color television. Most of the firms, however, have readied contingency plans to assemble color TV sets. In fact, one company has said it will begin making color TV sets for export in 1974, starting with an initial annual production of 3,000 sets.

Seven manufacturers share the TV receiver market, a situation that tends to make it difficult for any one of them to significantly improve its position. Four companies—Amron, Ltd. (licensee of Nordmende of Germany); Philco, Ltd. (subsidiary of the U.S. firm); Pilot, Ltd. (subsidiary of the United Kingdom firm); and Ralfo Israel, Ltd. (licensee of Metz of Germany)—account for 80% of total annual sales. Three others, including Tadiran (under license from Voxson of Italy) and subsidiaries of Salora (Finland) and Zenith (U.S.), make up the balance.

Israeli TV set makers import most of their components and parts, although one or two firms assemble their own tuners. This pattern is likely to remain unchanged when color TV telecasting is

introduced, opening up a new market to foreign-made color TV picture tubes and other components.

The Competitive Environment

Israeli output of product category components is expected to rise by an average of 25% per year, climbing from an estimated \$7.6 million in 1973 to more than \$18 million in 1977. During this period, production of resistors should almost triple from \$3.3 million to well over \$9 million, and output of capacitors should rise from \$2.7 million to \$5.2 million. The value of transistor production is projected to reach \$2 million in 1977, compared with \$950,000 in 1973. Output of IC's is forecast to advance from \$700,000 in 1973 to \$1.7 million in 1977.

Despite these substantial increases in production, Israel's electronic components producers will continue to play only a minor role in supplying the requirements of the country's electronic end products manufacturers. Most Israeli-made components are designed for the export market. Aggregate sales of resistors, capacitors, and transistors to European and American customers are forecast to approach \$15 million in 1977, up from their 1973 level of \$5.3 million.

Nine companies are engaged in the manufacture of product category components in Israel; two others make connectors, and one makes relays and rectifiers (other than semiconductor). Some of these firms are end product manufacturers that initially made only small quantities of components for in-house use or for sale to other Israeli manufacturers. Others were established by foreign firms that consider Israel a favorable locale from which to supply international markets. The influence of American manufacturers prevails throughout Israel's electronic components industry.

Only one producer—Elta—is wholly Israeli-owned. The thick/thin film hybrid modules, transformers, and microwave tubes Elta makes—some of them under license from Varian Associates (U.S.)—accounted for only a small part of its 1972 sales of \$14.5 million. Elta's total production of these components is either absorbed by its own plants or sold on the domestic market.

Tadiran makes a wider variety of electronic components than any other Israeli company. Its product line includes semiconductors (small signal and power transistors, linear integrated circuits, thick film hybrid integrated circuits); crystal products (quartz crystals, filters, and discriminators for communications equipment); and transformers and coils. Tadiran's own plants use 50% of the output; 20% is sold to other Israeli users, and 30% is exported, principally to European markets. License agreements applicable to Tadiran's component production

include accords with Western Electric and Damon Engineering, both of the United States.

One of the fastest-growing Israeli electronic components manufacturers is Vishay Israel, Ltd., a wholly-owned subsidiary of Vishay Intertechnology, Inc. (U.S.). Virtually its entire output of precision resistors and potentiometers is exported to the United States.

Another leading Israeli exporter of electronic components is Microelectronics, Ltd., which is a licensee of JFD Electronics Corporation of the United States. Microelectronics is owned, through an Israeli holding company, by the U.S.-based Whitaker Corporation. It exports 70 to 80% of its production of capacitors (variable glass, variable ceramic, variable air, fixed multilayer, and monolithic), mainly to European buyers. A Microelectronics subsidiary, Computer Components Corp., Ltd., makes silicon rectifier bridge assemblies, exporting some of its production to the United States.

Firms that produce entirely for the domestic market include: American Electronics Laboratories (Israel), Ltd. (film resistors, thick-film hybrid modules); Seac Israel, Ltd. (resistors and attenuators made with technical assistance from Seac of Italy); Elco Israel Electro-Mechanical Industry, Ltd. (large oil capacitors); Electro-Amin Israel, Ltd. (metalized mylar and polycarbonate fixed capacitors); S&R Zolotov (wire resistors, inductors); Elisra, Ltd. (multipin and edge connectors under license from the U.S. firm, Elco Corp); EMCI (connectors); and Taba Electronics Industry, Ltd. (rectifiers and relays, under license from Tresco Corp. of the United States).

The extent to which Israeli electronics firms have found it advantageous to integrate their production vertically has been severely hampered by the limited size of the domestic market and the wide variety of components needed by individual manufacturers. Furthermore, basic components are usually available more cheaply from abroad. Product category components are seldom made in-house unless there is a need to incorporate some unique feature. Several of Israel's larger electronics firms have indicated, however, that they plan to strengthen the component side of their operations. They expect their needs for custom-made components to increase as they develop more of their own product designs and rely less on blueprints supplied by foreign licensors. Tadiran is the most integrated firm at present; it makes most of its own inductors (transformers and coils) as well as a limited range of transistors and integrated circuits.

The participation of major European and Japanese manufacturers in the Israeli market for the surveyed components is confined mainly to sales of components used in radios and television sets and in certain types of telephone equipment. Well over

100 American suppliers of electronic components are represented in Israel, either under exclusive agreements with local electronic firms or with distributors, importers, and sales representatives. In contrast, only 45 third-country suppliers are represented in this market; half of these are British and German firms.

Few sales representatives find it useful to actively promote the sale of specific components. Indeed, many are totally unequipped to provide significant applications assistance. Israeli design engineers are avid readers of component manufacturers' catalogs and usually make their purchasing decisions on the basis of the information given therein.

Import duties.—Customs duties on electronic components range from 10 to 60%, with the highest duties being applied to color TV tubes, mounted piezoelectric crystals, and certain types of capacitors. In addition, there is a 20% surcharge on all imported goods, including electronic components. Duties and the surcharge are based on the cost, insurance, and freight (c.i.f.) value. Information on official duty rates applicable to specific items within the product category may be obtained from the U.S. Department of Commerce, Domestic and International Business Administration, Room 4217, Main Commerce, Washington, D.C. 20230.

A system of import licenses enables Israel to control the outflow of foreign exchange, allocating its use according to Government-established priorities.

Licenses covering the import of electronic components are usually granted promptly.

Importers of goods valued at more than \$1,190 are required to deposit with the Government a sum equivalent to 20% of the c.i.f. value of the merchandise. These deposits are returned, with interest, 6 months after the goods clear customs.

Technical Requirements

The electrical power supply characteristics throughout Israel are 230 volts, 50 hertz, single-phase. In addition, 380 volts, 3-phase is available for heavy-duty equipment.

The metric system of weights and measures is the statutory standard in Israel.

Published national standards for electronic components in Israel may be obtained through the American National Standards Institute, Inc., 1430 Broadway, New York, N.Y. 10018.

The following market research study, upon which this Country Market Survey is based, is available on loan from the U.S. Department of Commerce, Domestic and International Business Administration, Room 1617M, Main Commerce, Washington, D.C. 20230:

"The Market for Electronic Components in Israel,"
DIB 74-06-500, December 1973.

Italy

Sales of electronic components in Italy are forecast to rise substantially during the 1970's as Italian manufacturers strive to increase their share of the rapidly expanding domestic and foreign markets for electronic end-products. The country's output of finished electronic products is expected to nearly double from \$1.6 billion in 1972 to \$3 billion in 1977.

The Italian market for the selected groups of electronic components covered in this survey grew 52% between 1971 and 1973, climbing from \$89.5 million to \$135.7 million (see table 1). Purchases of these components are expected to rise at an 18% average annual rate during the years just ahead, reaching over \$260 million in 1977.

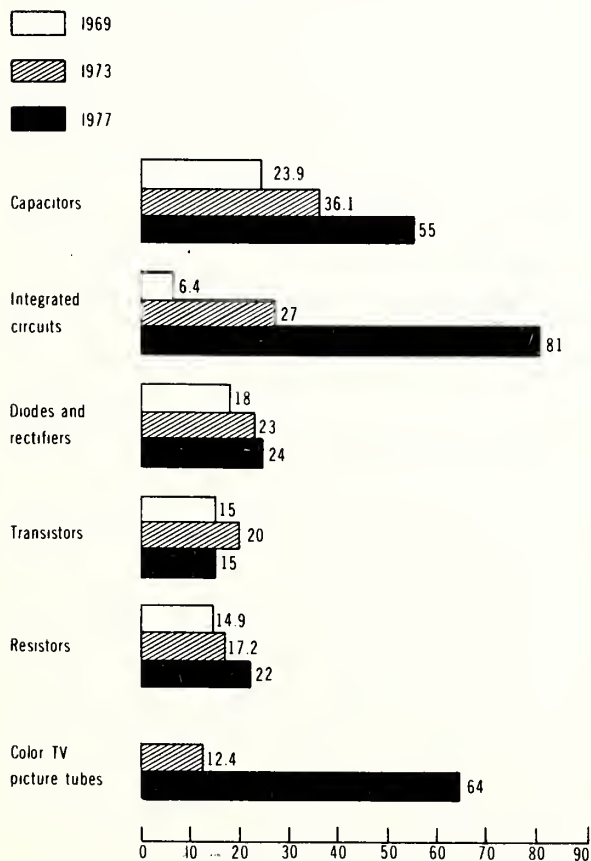
Imports averaged over 70% of the total Italian market for product category components during the 1971-73 period. During the same period, imports rose an average of 25% a year, climbing from \$63.4 million to \$99.8 million. The import market is expected to exceed \$170 million in 1977.

The United States was a leading foreign supplier of product category components to Italy in 1972, with a 19.9% share (\$17.2 million) of total imports (see table 2). It is estimated that increasing Italian demand for advanced components will result in annual sales of over \$35 million by U.S. suppliers in 1977.

The major foreign competition to U.S. suppliers of electronic components in the Italian market comes from German, French, Dutch, and Japanese manufacturers.

Italy: Size of market for selected groups of electronic components, 1969-77

(in millions of U.S. dollars)



Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

Sales Opportunities

Rising Italian demand for advanced electronic components, particularly by the telecommunications

Product Category Definition

Electronic components covered in this survey are basically confined to resistors, capacitors, color TV picture tubes, diodes and rectifiers, transistors, and integrated circuits.

The term "product category" as used in this publication is limited to these six groups of components.

**Italy—Selected Indicators
(1973)**

Gross national product:	\$137.0 billion
Population:	54.5 million
Total country imports:	\$25.5 billion
Imports from U.S.	
(w/share of total):	\$2.2 billion (8.6%)
Total country exports:	\$21.0 billion
Exports to U.S.	
(w/share of total):	\$2.0 billion (9.5%)
Exchange rate (May 1974):	625 lira = US\$1

and computer industries, should assure increased sales by U.S. suppliers. A market survey recently conducted in Italy for the U.S. Department of Commerce, Office of International Marketing reveals that favorable sales opportunities exist for American exporters of the following electronic components:

Capacitors.—Italy's capacitor market grew moderately from \$30.2 million in 1971 to \$36.1 million in 1973. Purchases are forecast to reach \$55 million in 1977, representing a better than 11% average yearly increase over the 1973 level.

The country's imports of capacitors are expected to top \$28 million in 1977, up from \$18.3 million in 1973 and \$12.7 million in 1971. Imports of American-made capacitors amounted to nearly \$2 million in 1972, representing a 12.5% share of the import market. Items in high demand include electrolytic capacitors and film and ceramic capacitors.

Integrated circuits.—The Italian market for integrated circuits more than doubled from \$11.8 million in 1971 to \$27 million in 1973. Sales of IC's are forecast to climb at an average rate of 30% annually between 1973 and 1977, surpassing \$80 million in the latter year.

Imports rose from \$9.5 million in 1971 to \$20 million in 1973 and are expected to reach \$55 million in 1977. The United States is Italy's leading supplier of integrated circuits. Its share of this import market increased from 20.5% (\$2 million) in 1971 to 41.5% (\$6.2 million) in 1972. Italian electronics manufacturers should continue to look to American suppliers to fill a large portion of their needs for integrated circuits, particularly the following types:

- TTL (MSI)
- ECL
- Digital
- Linear

The trend toward use of digital integrated circuits in Italian-made instrumentation and control equipment has been accelerated by the advent of LSI. Linear integrated circuits are being used in such control devices as operational amplifiers, D/A and

A/D converters, phase-lock loop circuits, and interface circuits. Advanced integrated circuits will also be used more extensively in voltage regulators, display drivers, converters, and operational amplifiers in the near future.

Manufacturers of telecommunications equipment reportedly are inclined toward the use of CMOS in their new designs. They also will need fast digital logic integrated circuits such as IF and audio amplifiers, voltage regulators, and other low-power devices. Olivetti Ing E&D S.p.A. (Torino), a major computer manufacturer, expects to begin using large-scale MOS as a replacement to DTL, bypassing the TTL stage entirely. Italy's most important automobile producer, Fiat, plans to utilize integrated circuits in its fuel injection systems, anti-skid mechanisms, seat belt interlock systems, ignition systems, automatic transmissions, and other automotive systems by the end of this decade. A further boost in demand for integrated circuits should result from the anticipated growth in domestic production of color television receivers after 1974.

Diodes and rectifiers.—The market for diodes and rectifiers grew 28% from \$18 million in 1971 to \$23 million in 1973 and should advance to \$24 million in 1977.

Imports in 1972 were valued at \$12.5 million, of which purchases from the United States accounted for \$2.6 million, or 20.8%. Power rectifiers and tunnel diodes should offer good sales potential for the next several years.

The overall increase projected for electronic equipment production in Italy should ensure a growing market for rectifiers, particularly for high-power types used in heavy industrial equipment. This should offset a slackening demand for low-current diodes that are steadily being displaced by integrated circuits.

Transistors.—Although the Italian market for transistors expanded from \$14 million in 1971 to \$20 million in 1973, a decline to \$15 million is expected for 1977 as integrated circuits gradually supplant transistors.

Imports should follow a similar pattern. Transistor imports are projected to drop to \$13 million in 1977, down from \$17 million in 1972 and \$18 million in 1973. Despite the overall slackening in demand, the market for silicon switching/power transistors and silicon n-p-n power transistors should experience steady growth through 1977.

Resistors.—Nearly all of Italy's needs for resistors are met by imports. The total resistor market in 1973 was valued at \$17.2 million, while imports amounted to \$19.5 million. The market should exceed \$22 million in 1977, and imports are expected to top \$24 million (see table 1). The United States in 1972 held an 18.5% share (\$3.4 million) of the \$18.2-million import market.

Color TV picture tubes.—Domestic production of color television sets is expected to rise appreciably when the Government announces the type of transmission—either the German PAL system or the French SECAM—that will be adopted. The television industry and consumers have been awaiting this decision and the initiation of color transmission for a number of years, and both may occur during 1974.

Based on this assumption, a 50% average annual increase is forecast for the Italian color TV picture tube market during the next 4 years, with sales rising from \$12.4 million in 1973 to about \$64 million in 1977.

Imports, which climbed from \$3.4 million in 1971 to \$11 million in 1973, are forecast to reach \$40 million in 1977. Purchases of U.S.-origin color TV picture tubes in 1972 amounted to \$792,000, or 10% of the \$8-million import market in that year.

Other electronic components.—Among the components outside the product category for which a good growth market is emerging in Italy are light-emitting diodes (LED's) and thyristors. Purchases of LED's totaled \$1.5 million in 1972 and are projected to reach \$8 million to \$10 million in 1977. LED's are now commonly used in Italian-made hand-held calculators and are gaining increasing acceptance in electronics generally.

Demand for thyristors also is expected to rise considerably when Italian production of color television receivers is fully underway. The thyristor market is forecast to reach about \$9 million in 1977, up from the 1972 level of \$3 million.

Selected End-User Industries

Italian production of finished electronic products rose 17% from \$1.37 billion in 1971 to \$1.6 billion in 1972. Output of industrial/commercial equipment accounted for 75% of the 1972 total and that of consumer electronic products accounted for the remainder. An estimated 65% of the number of semiconductors consumed in Italy is incorporated into industrial/commercial electronic equipment, while 35% is used in consumer goods.

The industrial/commercial equipment sector of Italy's electronics industry should continue to be the country's most important market for components. The Government's efforts to expand and upgrade telecommunications networks will result in a significant demand for advanced electronic components. A rapid rise in demand for a broad range of advanced components is also expected in the computer and automotive industries during the 1970's.

Government support for Italian industry is provided by the Institute for Industrial Reconstruction (IRI). Through the IRI, the Government either

Italy—The Electronics Industry Basic Data (1972)

Total value of production:	\$1.8 billion
Number of manufacturers (1971):	1,300
Industry labor force:	77,500
Output of principal electronic components user industries—	
Consumer products industries:	
television sets	\$233 million
Industrial/commercial equipment industries:	
computers and related equipment	\$223 million
telecommunications equipment	\$766 million
measuring and testing instruments	\$65 million
medical electronic equipment	\$41 million

owns or has a controlling interest in a number of the country's industrial concerns, including radio and television, computer, and telecommunications companies. Public investment in the telecommunications industry during the 1973-77 period is expected to total \$5.6 billion. In addition, the Government plans to spend \$235 million during the same period in an effort to help improve the efficiency and profitability of the country's computer and electronic components industries.

Industrial/commercial equipment sector.—Italian production of industrial/commercial electronic equipment amounted to nearly \$1.2 billion in 1972 and is expected to nearly double to \$2.3 billion in 1977. The sector has a workforce of some 50,000 people.

Telecommunications equipment.—Italian output of telecommunications equipment was valued at \$548 million in 1972, representing a sharp increase from production levels of \$303 million in 1970 and \$260 million in 1968. Production of exchange and switching equipment accounted for 70% (\$384 million) of the 1972 total. By 1977, annual output of telecommunications equipment should exceed \$1 billion, most of which will be consumed locally.

Increased demand for telephone service in Italy has been the most important factor spurring the industry's output. The Societa Italiana per l'Esercizio Telefonico (SIP), the national telephone company, invested \$460 million in new equipment in 1972, resulting in a more than 9% increase in subscribers over the previous year's figure. At the end of 1972, Italy had a total of 7.6 million telephone subscribers with 11.3 million telephones installed. Italy's telephone density in that year was

Table 1.—Italy: Size of market¹ for selected groups of electronic components, 1969-77
(in millions of U.S. dollars)

Description	1969	1971	1972	1973	1974	1977
<i>Resistors</i>						
Production ²	4.3	3.4	2.7	2.0	2.0	1.6
Imports	15.5	13.7	18.2	19.5	20.9	24.2
Exports	4.9	3.6	5.1	4.3	4.0	3.5
Market size	14.9	13.5	15.8	17.2	18.9	22.3
<i>Capacitors</i>						
Production ²	26.4	35.3	37.8	42.7	47.4	62.3
Imports	11.4	12.7	15.8	18.3	20.9	28.1
Exports	13.9	17.8	22.3	24.9	27.1	35.4
Market size	23.9	30.2	31.3	36.1	41.2	55.0
<i>Color TV picture tubes</i>						
Production ²	—	3.8	20.2	42.8	63.7	123.7
Imports	—	3.4	8.0	11.0	20.0	40.0
Exports	—	5.2	20.0	41.4	50.0	100.0
Market size	*	2.0	8.2	12.4	33.7	63.7
<i>Diodes and rectifiers</i>						
Production ²	11.9	12.8	16.0	18.0	20.0	24.0
Imports	12.8	12.1	12.5	13.0	11.5	10.0
Exports	6.7	6.9	7.6	8.0	8.5	10.0
Market size	18.0	18.0	20.9	23.0	23.0	24.0
<i>Transistors</i>						
Production ²	13.8	21.7	23.0	24.0	25.0	22.0
Imports	16.8	12.0	17.0	18.0	17.0	13.0
Exports	15.6	19.7	21.4	22.0	23.0	20.0
Market size	15.0	14.0	18.6	20.0	19.0	15.0
<i>Integrated circuits</i>						
Production ²	3.8	9.5	18.3	25.0	37.0	60.0
Imports	8.1	9.5	14.9	20.0	27.0	55.0
Exports	5.5	7.2	13.2	18.0	27.0	34.0
Market size	6.4	11.8	20.0	27.0	37.0	81.0
<i>Totals</i>						
Production ²	60.2	86.5	118.0	154.5	195.1	293.6
Imports	64.6	63.4	86.4	99.8	117.3	170.3
Exports	46.6	60.4	89.6	118.6	139.6	202.9
Market size	78.2	89.5	114.8	135.7	172.8	261.0

¹ Size of market equals production plus imports minus exports. Parts and accessories not included.

² Production figures for 1969-73 include components manufactured by OEM's for their own use. In-house production of resistors represents 5% of the total; capacitors, 15%; color TV picture tubes, 85%; diodes and rectifiers, 30%; transistors, 25%; and integrated circuits, 30%.

³ Insignificant.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

20.8 telephones per 100 inhabitants, more than double the 1962 ratio. SIP's investment in new equipment in 1973 was estimated at \$1 billion.

SIP is gradually switching over to pulse code modulation (PCM) circuits for short-distance transmission. Although electronic transmission is becoming standard in Italy, electronic switching is being used only on an experimental basis. A change to fully electronic systems is probable in the next few years.

Virtually all of SIP's purchases are made through six major companies. They are Societa Italiana Telecomunicazione Siemens S.p.A., a subsidiary of Siemens AG; FACE Standard, a subsidiary of ITT; GTE Telecomunicazioni S.p.A., a subsidiary of GT&E; Telettra S.p.A. (Milan), a private Italian-owned firm; and Fabbrica Apparechiature Tele-

foniche e Materiale Elettrica Brevetti Ericsson (FATME); and Impianti Elettrici e Telefonici Sistema Ericsson (SIELTE), both subsidiaries of L. M. Ericsson. SIP and its principal suppliers buy electronic equipment and components from the United States when comparable devices are not available locally. Both Siemens and Telettra, for example, recently placed orders for American-made computer-controlled electronic circuit testers. The gradual changeover to electronic circuitry in Italy's telephone system should result in increased opportunities for sales of advanced electronic components by U.S. suppliers.

Computers and related equipment.—Italy's output of computers and related equipment was valued at more than \$223 million in 1972, a 22% jump over the 1971 level of \$183 million. Of the 1972

total, output of computers amounted to \$154.6 million, while that of peripherals was valued at \$68.7 million. The industry's total production is expected to rise at an annual rate of between 20 and 25%, reaching nearly \$600 million in 1977.

Olivetti launched the Italian computer industry in the 1950's. However, General Electric, under an agreement with Olivetti, took over the latter company's production. The GE establishment, now a Honeywell subsidiary known as Honeywell Information Systems Italia S.p.A., consists of a plant at Caluso and a research center at Pregnana. Olivetti, in Turin, recently reentered the computer field with its Series P600 business computers. IBM also has an Italian manufacturing subsidiary, known as IBM Italia S.p.A., which started production in 1966 and manufactures the 360/20, 360/22, 370/125, and Systems/3 in its Vimercate plant.

Two large organizations control the other domestic computer companies. The first is under the auspices of the Government agency Societa Finanziaria Telefonica (STET), which forms one branch of the Institute for Industrial Reconstruction (IRI). Three firms, Selenia-Industrie Elettroniche Associate S.p.A., Pignone Sud S.p.A., and Elettronica San Giorgio, are controlled by the STET but operate independently of each other. The latter two firms manufacture minicomputers, and Selenia produces process control computers and telecommunications equipment. The second group is part of the Montecatini-Edison complex and includes LABEN in Milan, Industria Macchine Elettroniche (IME) in Rome, and Officine Transformatori Elettrici (OTE) in Florence. IME manufactures desk calculators, minicomputers, and input/output devices. LABEN and OTE both make minicomputers.

Communications equipment.—Production of communications equipment in 1972 totaled \$218 million, more than double the 1970 level of \$99.6 million. Production of radio communications equipment in 1972 was valued at \$65 million; public broadcasting equipment, \$54 million; and radar and navigational aids, \$98 million.

Consumer products sector.—The Italian consumer electronics sector, with approximately 14,700 employees, recorded a nearly 13% increase in output from 1971 (\$350 million) to 1972 (\$395 million). The projected 1977 production level is \$700 million.

Television receivers.—Television receiver manufacturing is by far the largest industry within the consumer products sector, accounting for nearly 60% of the sector's total output in 1972. The commencement of color TV transmission in Italy should result in a boom period for the country's television set producers. Large-scale manufacture has been delayed in anticipation of the Government's decision on the type of transmission to be adopted. A few Italian manufacturers, encouraged by the strong foreign market for color sets and by their hopes for an early decision on domestic transmission, started to produce PAL sets in 1970. Northern Italy already has a small market for color TV sets because Swiss, French, and Yugoslav stations can be received. Production of color sets doubled from 50,000 units in 1971 to 100,000 in 1972 and is expected to reach 850,000 in 1977, assuming Italian color transmission begins in 1974.

Domestic production of black-and-white sets is projected to decline from 1.9 million units in 1973 to 900,000 in 1977. The trend in monochrome receiver production is away from the large sets toward portable TV's; about 45% of 1973 output represented large-screen models while 55% was composed of smaller models. The new designs for monochrome televisions include four or five integrated circuits in each set.

The National Association of Electronic Industries (ANIE), in Italy has requested the Government to initiate broadcasting with a third black-and-white channel and to adopt cable TV. These measures, if implemented, would have a salutary effect on television receiver sales.

The major manufacturers of TV sets in Italy are Philips, CGE Telefunken, Zanussi A Industrie S.p.A., Grundig-Minerva, Phonola, Autovox S.p.A.,

Table 2.—Italy: Imports from the United States, and U.S. share of total imports, of selected groups of electronic components, 1969-72¹
(in thousands of U.S. dollars)

Description	1969		1971		1972	
	Value	U.S. share (percent)	Value	U.S. share (percent)	Value	U.S. share (percent)
Resistors	3,391	21.9	2,950	21.5	3,374	18.5
Capacitors	2,216	19.4	2,045	16.1	1,972	12.5
Color TV picture tubes	n.a.	—	n.a.	—	892	9.9
Diodes and rectifiers	4,293	33.5	2,766	22.9	2,600	20.8
Transistors	7,520	44.8	2,906	24.2	2,244	13.2
Integrated circuits	4,769	58.9	1,944	20.5	6,186	41.5
Total	22,189	34.3	12,611	19.9	17,168	19.9

¹ Parts and accessories not included.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

and Voxon S.p.A. A number of these firms are associated with large foreign companies. Phonola is a subsidiary of Philips, and Autovox is now part of Motorola. AEG-Telefunken presently holds 25% of Zanussi stock, while EMI owns 50% of Voxon.

The Competitive Environment

Italian production of the electronic components under review amounted to \$154.5 million in 1973 and is expected to approach \$295 million in 1977. Annual exports are projected to climb from \$118.6 million to more than \$200 million during the same period. A total of 12,750 people are employed by over 40 firms in Italy's electronic components industry.

The major strengths of the domestic industry lie in the production of capacitors, color TV picture tubes and, increasingly, integrated circuits. The most significant producers of capacitors in the country are Ducati Elettrotecnica Mi-Crofarad S.p.A., Fabbrica Componenti Elettrici (FA.C.EL srl), Industriale Condensatori Applicazioni Elettroniche (ICAR), MIAL S.p.A., Plessey ARCO S.p.A., and Procond S.p.A.

Most of the color TV picture tubes manufactured in Italy to date have been exported, due to the lack of local color television transmission. The high proportion of tubes exported to France—about 67%—is primarily accounted for by the fact that Italy's major producer, Videocolor S.p.A., is controlled by the French concern Thomson-CSF.

Italy's two major manufacturers of integrated circuits are General Instrument Europe S.p.A. and SGS-ATES Componenti Elettronici S.p.A. The latter company, with plants at Agrate and Catania, was formed as the result of a merger between Societa General Semiconduttori S.p.A. (SGS) and Aziende Tecniche Elettroniche del Sud (ATES). The Government holds a 60% share of the combined company, while Fiat and Olivetti each hold 20%. SGS-ATES, under licensing arrangements with the U.S. companies Fairchild and RCA, produces a wide variety of components, ranging from discrete semiconductors to bipolar digital and complementary MOS integrated circuits. The firm is particularly strong in linear integrated circuits for consumer applications, which account for 30% of sales. SGS-ATES planned to invest \$15.7 million on expanded production and research facilities in order to raise output by 50% in 1974. General Instrument, based in Naples, manufactures a number of semiconductor devices, but its integrated circuit production is devoted entirely to MOS.

Italy is a net exporter of transistors, with about 80% of the exports destined for Germany, France, the Netherlands, and the United Kingdom. MIS-TRAL S.p.A., SGS-ATES, and Texas Instruments Italia S.p.A. are the major transistor producers in

the country. These firms also manufacture diodes and rectifiers along with a number of other companies, such as Ansaldo San Giorgio Compagnie Generale (ASGEN), International Rectifier, Tecnomasio Italiano Brown-Boveri S.p.A., and Tumgram S.p.A.

U.S.-made components highly regarded.—Italian firms view the United States as the prime source for sophisticated semiconductor devices. American companies therefore are likely to remain the country's leading suppliers of advanced componentry, particularly integrated circuits, for the foreseeable future. Among the American companies exporting components to Italy are Beckman Instruments, Inc.; Elco Corporation; ITT Cannon Electric Division; Motorola Semiconductor Products, Inc.; National Semiconductor Corporation; and Westinghouse Electric Corporation.

Germany is another important supplier of electronic components to Italy, accounting for 25.1% of the country's import market for integrated circuits in 1972 and over 30% of the import market for transistors. Alois Zettler GmbH, Dr. Bernhard Beyschlag, Ernst Roederstein GmbH, Siemens AG, and Sühner Elektronik GmbH are among the leading German exporters to Italy. Major French suppliers include Cogeco S.A., B. Precis S.A., Radiall S.A., Silec Semiconductors, Socapex S.A., and Sovcor Electronique S.A. British companies active in the market include AEI Semiconductors, Ltd.; Belling & Lee, Ltd.; Plessey Co., Ltd.; and Westinghouse Brake & Signal Co. The Dutch company Philips N.V., the Swedish firm Rifa A.B., and the Japanese concern Omron Tateisi Electronics Co. also have made successful inroads in the Italian electronic components market.

Import duties.—Italy is a member of the European Economic Community (EEC) and applies the Common External Tariff (CXT) to all goods imported from non-EEC countries. The CXT rate of duty, applied to the cost, insurance, and freight (c.i.f.) value of imports, ranges from 6.5% on switches, relays, and connectors to 17% on microcircuit semiconductor devices. Italy also assesses a value-added tax (TVA) of 12% on the c.i.f. duty-paid value on imported components. TVA applies to all manufactured products, including those made in Italy. In addition, a new tariff adopted by EEC and European Free Trade Association (EFTA) countries provides that both organizations will assess full duties against any product shipped from one European trade-group nation to another if 41% of the value of the product was made outside the EEC or EFTA or if more than 3% of its value included transistors made outside either group.

Information on official duty rates applicable to specific types of components within the product category may be obtained from the U.S. Department

of Commerce, Domestic and International Business Administration, Room 4217, Main Commerce, Washington, D.C. 20230.

Technical Requirements

Italy's electrical power supply characteristics are 220/380 volts, single- or 3-phase, 50 hertz.

The metric system of weights and measures is the statutory standard in Italy.

Published national standards for electronic components in Italy may be obtained through the Amer-

ican National Standards Institute, Inc., 1430 Broadway, New York, N.Y. 10018.

The following market research study, upon which this Country Market Survey is based, is available on loan from the U.S. Department of Commerce, Domestic and International Business Administration, Room 1617M, Main Commerce, Washington, D.C. 20230:

"The Market for Electronic Components in Italy,"
DIB 74-06-503, November 1973.

Japan

Japan offers American exporters of electronic components an excellent market for their products. The 1973 market for the components covered in this survey exceeded \$2.4 billion, an increase of 88% over 1971 sales of \$1.3 billion (see table 1).

Growth in demand for these components is assured by several factors affecting the Japanese electronics industry—the increasing demand for industrial control equipment, display devices, and electronic meters; the expected growth of the computer industry; and the continuing expansion of desk-top and pocket calculator production.

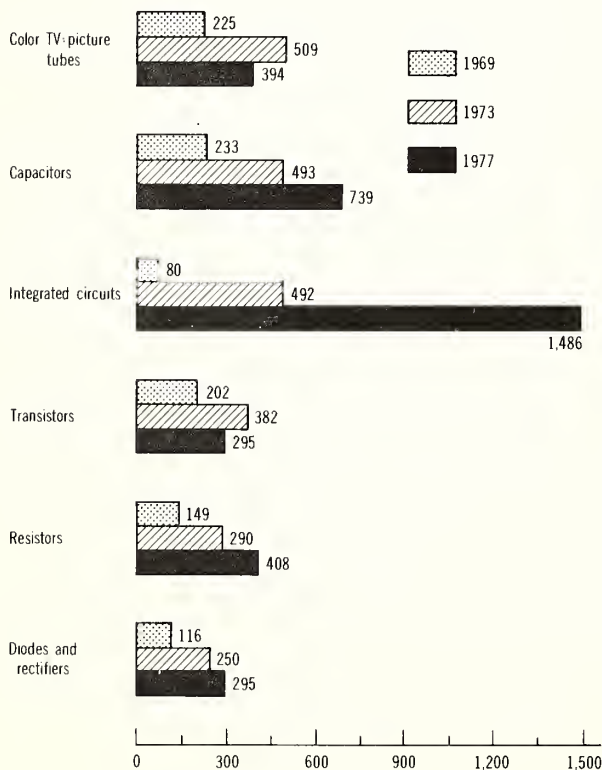
Japanese industry sources predict that sales of components in the product category will climb at an average annual rate of almost 11% between 1973 and 1977, reaching more than \$3.6 billion.

Japanese imports of the components under review have been increasing rapidly, rising an average of 33% annually between 1971 and 1973. Growth of imports during the 1973-77 period is expected to average 42% annually. Imports totaled \$167 million in 1973, representing 7% of the market. Forecasts indicate that imports should reach over \$680 million in 1977, supplying about 20% of Japan's requirements.

The United States is the principal supplier of product category components to Japan. Although imports of these components from the United States rose from \$43 million in 1969 to \$47.7 million in 1972, the U.S. share of the import market declined from 80.3 to 57.1% during the same period (see table 2). This decline reflected an increase in imports of components from both U.S. and Japanese subsidiaries in Korea and other Southeast Asian countries. Components imported from these developing

Japan: Size of market for selected groups of electronic components, 1969-77

(in millions of U.S. dollars)



Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

Product Category Definition

Electronic components covered in this survey are basically confined to resistors, capacitors, color TV picture tubes, diodes and rectifiers, transistors, and integrated circuits.

The term "product category" as used in this publication is limited to these six groups of components.

Japan—Selected Indicators

1973

Gross national product (est.):	\$407.9 billion
Population:	108,700,000
Total country imports:	\$38.3 billion
Imports from U.S. (w/share of total):	\$9.3 billion (24.2%)
Total country exports:	\$36.9 billion
Exports to U.S. (w/share of total):	\$9.5 billion (25.6%)
Exchange rate (May 1974):	278 yen=US\$1

countries, however, are primarily the lower cost, less sophisticated devices. Japan still looks to the United States for advanced products.

The expected rise in Japanese production of industrial electronic equipment, which will require larger quantities of more sophisticated components, should lead to an increase in the U.S. share of the country's component imports. Trade sources predict that by 1977 the United States will hold 60 to 75% of the Japanese import market for electronic components within the product category.

Sales Opportunities

U.S. electronic components producers will find excellent sales opportunities in Japan for many of their more advanced products since the Japanese trail the Americans in the development and mass production of new technology components. Japanese manufacturers of electronic finished goods rapidly incorporate newly developed U.S.-made components into their products to maintain their high competitive position in the world market.

A market research survey recently conducted in Japan for the U.S. Department of Commerce, Office of International Marketing, reveals that favorable sales opportunities exist for American exporters of the following electronic components:

Color TV picture tubes.—The market for imported color TV picture tubes in Japan has been small—only \$300,000 in 1973—but it is expected to grow rapidly. Imports are predicted to rise at an average annual rate of 75% during the next 4 years, reaching \$2.8 million in 1977.

The highest growth is expected in imports of color CRT's for industrial use or for display devices for computers. Purchases of imported CRT's for color TV's should increase at a slower rate, although Japanese demand for color television is still active. Domestic production of color TV tubes increased 41% between 1972 and 1973, climbing from \$397 million to \$560 million.

Capacitors.—Japanese capacitor purchases to-

taled \$239 million in 1971 and reached \$492.9 million in 1973, representing an average rise of 44% each year. Although demand for some types of capacitors will diminish as they are displaced by IC's, the market should rise about 11% annually between 1973 and 1977, advancing to \$739 million.

Imports are expected to grow faster than the total market during this period, increasing at an average rate of 21% annually. They should exceed \$25 million in 1977. The United States held 26.2% of the import market in 1972 despite increased imports of capacitors from Japanese subsidiaries in Southeast Asia.

U.S. manufacturers can expect to continue as a major source of special high-quality capacitors for the Japanese electronics industry. Demand is increasing rapidly for multilayer ceramic chip capacitors for use in hybrid IC's. The 1973 market for ceramic capacitors reached \$117 million, nearly double the 1971 level of \$59 million. Industry sources expect sales of multilayer ceramic capacitors to increase an average of 30% annually during the next 4 years.

Integrated circuits.—The Japanese market for IC's totaled \$208.4 million in 1971 and then rose an average of 55% annually to reach \$492 million in 1973. Sales are expected to grow at an average rate of 32% annually during the next 4 years. They should approach \$1.5 billion in 1977 as IC's continue to displace transistors, capacitors, and resistors in Japanese electronic products.

The rising demand for IC's for computers, calculators, and other electronic end products cannot be met locally, and the market share supplied by imports is expected to increase from 32% in 1971 to 40% in 1977. Purchases of American-made IC's totaled \$29 million in 1972, accounting for 59.2% of the import market. U.S. manufacturers are the major source of MOS-LSI's and MOS memories used in Japanese computers and calculators.

C/MOS integrated circuits for display drives, meters, and gauges, are expected to be in great demand in the near future. One of the principal uses of C/MOS devices in Japan will be for wristwatches. Production of electronic watches in Japan began in the summer of 1972, and 2.5 million were manufactured in 1973. By 1978, the industry expects 40% of all wristwatches made in Japan to be electronic.

Resistors.—Demand for reliable, high-quality resistors is expected to multiply as the electronics industry in Japan shifts emphasis on output from consumer to industrial products. These more advanced resistors are supplied mainly by U.S. manufacturers, as evidenced by the high value per unit of resistors imported into Japan from the United States.

For example, the average value per unit of imported variable resistors in 1972 was 17 cents, while the average value per unit of such resistors imported from the United States was \$4.05. Similarly, the average value of imported fixed resistors was \$4 per kilogram in 1972, compared to \$38.00 per kilogram for resistors purchased from U.S. firms.

The growth in Japanese production of electronic consumer goods, especially TV sets and radios, already has created a substantial market for resistors. Sales rose from \$158.9 million in 1971 to \$289.7 million in 1973, representing an average yearly growth rate of 35%. The trend toward wider use of IC's in consumer products is expected to reduce the growth rate to about 9% annually during the 1973-77 period.

Imports of resistors, however, are forecast to increase by 24% annually through this period, with purchases of foreign-made resistors expected to exceed \$24 million in 1977. The United States is the major source of these imports, supplying 61.8% (\$3.7 million) of the \$6 million import market in 1972.

The best sales opportunities for U.S. producers will be found in wirewound and metal film resistors. The market for wirewound resistors, used mostly in industrial equipment, grew from \$10 million in 1971 to \$22 million in 1973. Sales of metal film resistors more than doubled, from \$7 million to \$15 million, during the same period. The color TV receiver, computer, audio, and avionics equipment industries are expected to use increasing numbers of metal film resistors.

Transistors.—American transistor manufacturers should find good sales opportunities in Japan despite the expected decline in the transistor market arising from the shift to IC's. Demand should continue to be strong for specialized high-technology devices developed in the United States, particularly for transistors with high-frequency, high-power, low-noise, and high-power field effect.

The overall transistor market in Japan rose from \$236 million in 1971 to \$381.6 million in 1973, an average annual increase of 27%. However, sales are projected to decline about 6 to 7% annually between 1973 and 1977.

Imports of all types of transistors grew at an average rate of 35% annually, going from \$11 million in 1971 to \$20 million in 1973, but are expected to decline to \$15 million in 1977. U.S. manufacturers supplied 54.5% of 1972 imports and should continue to dominate the import market as the demand for transistors narrows to higher technology components.

Other electronic components.—In addition to the six component groups surveyed, good sales opportunities will be found in Japan for U.S. producers of the following electronic components:

Japan—The Electronics Industry Basic Data (1972)

Total value of production:	\$11.9 billion
Number of manufacturers (1969):	11,193
Industry labor force (1969):	804,976
Output of principal electronic components user industries—	
Consumer products industries:	
radios	\$411 million
television receivers	\$2.5 billion
audio equipment	\$1.7 billion
calculators	\$355 million
Industrial/commercial equipment industries:	
computers and related equipment	\$1.3 billion
telecommunications equipment	\$1.4 billion
measuring and testing instruments	\$208 million
industrial equipment	\$219 million

- Printed circuit connectors
- Thyristors
- Varistors
- Thermistors
- Light emitting diodes
- Liquid crystal

The market for printed circuit connectors will expand with growing use of IC's and LSI's. Also, as the emphasis in the Japanese electronics industry shifts from consumer products to industrial equipment, demand should increase for connectors to be used in communications equipment, computers, and medical electronic equipment.

Nippon Telephone and Telegraph Corporation (NTT) started to use connectors in 1966 for its push-button telephones and has converted to switchboards requiring a large volume of connectors. Japanese producers are only familiar with coaxial connectors and must depend on licensing agreements for the production of new technology connectors, leaving U.S. suppliers with a good potential market for PC and other high-quality connectors.

Japanese component manufacturers are reluctant to commercialize new technology items until they are assured of a steady future demand. The Japanese electronics industry therefore must rely on imports for such items as advanced thyristors, varistors, and thermistors.

LED's will be in increasing demand over the next few years for ammeters, volt and automotive meters, and other equipment with numerical displays. Industry sources predict that by 1975 LED's will be used in 50% of all Japanese pocket calculators.

Table 1.—Japan: Size of market¹ for selected groups of electronic components, 1971-77
(quantity in millions of units; value in millions of U.S. dollars)

Description	1971		1972		1973		1977	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
<i>Resistors</i>								
Production ²	12,104	176.8	13,834	227.3	17,147	341.7	24,800	488.7
Imports	210	4.5	276	6.0	414	10.6	977	24.5
Exports	2,366	22.4	3,211	34.4	5,474	62.6	9,700	105.7
Market size	9,948	158.9	10,899	198.9	12,087	289.7	16,077	407.5
<i>Capacitors</i>								
Production ²	10,532	275.6	13,683	371.7	16,741	583.8	25,000	867.9
Imports	163	5.0	216	7.1	282	11.7	600	25.3
Exports	2,007	41.6	3,083	61.6	4,018	102.6	6,300	154.7
Market size	8,688	239.0	10,816	317.2	13,005	492.9	19,300	738.5
<i>Color TV picture tubes</i>								
Production ²	8	310.3	10	397.1	11	560.4	12	543.4
Imports	—	—	—	.1	—	.3	—	2.8
Exports	—	10.9	1	27.1	1	51.7	3	152.8
Market size	8	299.4	9	370.1	10	509.0	9	393.4
<i>Diodes and rectifiers</i>								
Production ²	1,396	139.1	2,062	176.5	2,162	249.6	2,780	294.3
Imports	103	7.5	139	8.3	133	11.6	135	12.5
Exports	137	7.6	189	7.7	218	10.8	207	12.1
Market size	1,362	139.0	2,012	177.1	2,077	250.4	2,708	294.7
<i>Transistors</i>								
Production ²	1,638	240.5	2,175	296.2	2,310	396.8	2,000	301.9
Imports	106	11.0	148	12.8	190	20.0	150	15.1
Exports	168	15.5	281	24.2	313	35.2	280	22.6
Market size	1,576	236.0	2,042	284.8	2,187	381.6	1,870	294.4
<i>Integrated circuits</i>								
Production ²	130	141.2	205	216.3	283	384.5	799	904.5
Imports	22	67.2	39	49.2	105	113.2	533	603.8
Exports	—	—	5	5.4	4	5.7	20	22.6
Market size	152	208.4	239	260.1	384	492.0	1,312	1,485.7
<i>Totals</i>								
Production ²	25,808	1,283.5	31,969	1,685.1	38,654	2,516.8	55,391	3,400.7
Imports	604	95.2	818	83.5	1,124	167.4	2,395	684.0
Exports	4,678	98.0	6,770	160.4	10,028	268.6	16,510	470.5
Market size	21,734	1,280.7	26,017	1,608.2	29,750	2,415.6	41,276	3,614.2

¹ Size of market equals production plus imports minus exports. Parts and accessories not included.

² Production figures for 1971-73 include components manufactured by OEM's for their own use. In-house production of resistors represents about 10 to 15% of the total; capacitors, 6%; color TV picture tubes, 90%; diodes and rectifiers, 60%; transistors, 90%; and integrated circuits, 88%.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

However, the Japanese expect liquid crystal to replace LED's in most applications by 1980.

Seiko (Seikosha and Co., Ltd., Tokyo) digital watches with liquid crystal displays were scheduled to be introduced in the first half of 1974. Sharp Co., Ltd., of Osaka, produces a calculator using liquid crystal, and Matsushita Electric Trading Co., Ltd., of Tokyo, is about to market a liquid crystal clock. The development of display devices for industrial use built around liquid crystals is expected in the near future.

Selected End-User Industries

Japanese production of finished electronic products totaled \$8.5 billion in 1972. The consumer

products sector accounted for 60% of the output (\$5.1 billion) and the industrial/commercial equipment sector accounted for 40% (\$3.4 billion). Total output is expected to expand at an average rate of 14% annually between 1972 and 1977, reaching \$16.6 billion. Trade sources predict that consumer goods will account for 45% of output in 1977, while industrial/commercial products will represent 55%.

The Japan Electronics Machinery Manufacturers Association (JEMMA) estimates that 1.6% of industrial production of electronic equipment in 1970 and 2% in 1972 was for military use. Output of military goods grew at an average annual rate of about 6% between 1969 and 1972, but against a small base.

Legislation enacted in 1971 by the Japanese Government is aimed largely at helping the Japanese electronics industry close the gap between U.S. and Japanese technological levels. The law incorporates a series of technological goals devised to stimulate the growth of industrial (chiefly computer-related) electronic products.

The 1971 legislation included a budget suggesting that government and industry together should spend \$1.4 billion on R&D between 1971 and 1977, with 67% of the funds assigned to the development of computers, 10% for electronic components, 8% for communications equipment (including optoelectronics), and 5% for electronic equipment for aviation and space applications.

Industrial/commercial equipment sector.—Production in the industrial/commercial equipment sector increased at an average annual rate of 21% between 1969 and 1972. Trade sources estimate that output by this sector will increase 22% annually between 1972 and 1977, leading to a yearly production level of \$9.1 billion. Production of the telecommunications equipment industry, the largest subsector, rose at an average annual rate of 16.5% between 1969 (\$897 million) and 1972 (\$1.4 billion).

The entire sector in 1969 employed nearly 200,000 workers in more than 2,000 firms. Capital investment in plant and equipment in 1973 totaled \$184.5 million, more than 90% higher than in 1972. The largest investment is taking place in the computer industry.

Computers and related equipment.—The fastest growing industry within the industrial/commercial equipment sector, in terms of production as well as capital investment, is the computer and related equipment industry. Nearly 500 companies, with 54,000 employees, produced computers and related equipment valued at \$544 million in 1969 (see table 3). Production rose an average of 32% yearly to nearly \$1.3 billion in 1972. JEMMA estimates that the computer industry's output will reach \$4.5

billion in 1975, an average increase of more than 50% per year from the 1972 level.

Japan's computer manufacturing industry is heavily supported by the government through quantitative restrictions and tariffs on imports of EDP and related equipment, restraints on investment of foreign capital, and direct technical assistance.

A project concerning the development of ultra-high performance computers was started in 1966 and was fully financed (for \$133 million) through the Agency of Science and Technology of the Ministry of International Trade and Industry (MITI). As a result of the project, a prototype machine with eight megabyte was produced in 1971, employing LSI and pipeline control techniques.

Current research efforts include an 8-year project to develop a pattern information processing system capable of recognizing and processing written characters, designs and figures, objects, and voices. A pilot model capable of character, figure, object, and voice recognition is targeted for 1974-76, and a complete system is envisioned by 1978. Nearly \$116 million has been budgeted for this effort.

The Japanese Government in 1972 announced a new 5-year plan of financial support to the domestic computer industry, with major emphasis on research and development of "3.75 generation" computers, including peripheral equipment and software that would be competitive with advanced systems made in the United States.

Japan's national budget for fiscal 1973 included \$130 million for R&D subsidies in electronics and related fields. Developers of large-capacity computers received 35% of the allocations, while 39% went to the Government-supported Japan Electronic Computer Co. (JECC) to promote the use of large-capacity computers on a time-sharing and lease basis. Projects related to data transmission, including facsimile and visual display transmission, received 18%, while lesser allocations were provided for the improvement of data processing and

Table 2.—Japan: Imports from the United States, and U.S. share (by value) of total imports, of selected groups of electronic components, 1969-71¹
(quantity in thousands of units; value in thousands of U.S. dollars)

Description	1969			1971			1972		
	Quantity	Value	U.S. share (percent)	Quantity	Value	U.S. share (percent)	Quantity	Value	U.S. share (percent)
Resistors ²	n.a.	2,941	91.0	17,446	3,305	73.5	19,419	3,700	61.8
Capacitors ²	26,845	1,650	44.5	18,131	1,800	36.2	18,942	1,859	26.2
Color TV picture tubes	1	150	85.7	—	41	87.2	—	83	92.2
Diodes and rectifiers	112,296	7,286	81.9	54,811	5,986	80.0	59,138	5,925	71.2
Transistors	35,749	11,172	70.5	19,855	6,475	59.1	20,109	6,976	54.5
Integrated circuits	14,615	19,802	91.2	13,554	56,611	84.2	13,416	29,125	59.2
Total	—	43,001	80.3	123,797	74,218	78.0	131,024	47,668	57.1

¹ Parts and accessories not included.

² Quantity in kilograms.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

transmission within government agencies and in small and medium-scale companies.

The JECC, which is owned jointly by the six major Japanese mainframe producers, was formed in 1961 to establish a system of computer rental that would enable more industries to automate their data processing operations. The company is the beneficiary of loans from the Japan Development Bank at a subsidized rate of 7.5%, which enables it to extend favorable rental terms to EDP users. JECC also may dictate a maximum allowable value for foreign electronic components to be included in the computer systems it buys if similar components are available from local manufacturers.

Future growth of the Japanese computer industry seems assured. The government expects to continue to support the industry. The JECC is increasing the funds available for rental of computers within Japanese industry and also is initiating an overseas rental plan for Japanese computers.

Plans by the major computer manufacturers to increase software production also should stimulate computer sales by broadening the range of possible applications. In view of the expected future market growth, computer manufacturers are enlarging their facilities. Capital investment in plant and equipment by the Japanese computer industry in 1973 reached \$85.3 million, nearly double the 1972 outlay of \$44 million.

Eight manufacturers dominate the Japanese computer industry, supplying more than 93% of the domestic market. These include six wholly-owned Japanese firms; one U.S. subsidiary, IBM Japan, Ltd.; and one U.S.-Japan joint venture company, Oki-Univac Co., Ltd., owned by Oki Electric Industry Co., Ltd., and Sperry Rand Corp. Their respective shares of the Japanese computer market are as follows:

	1972	1973
IBM Japan, Ltd.	28.2	29.8
Fujitsu Co., Ltd.	16.2	18.0
Nippon Electric Corp. (NEC)	16.7	14.4
Hitachi, Ltd.	12.5	13.6
Oki-Univac Co., Ltd.	9.8	9.1
Tokyo Shibaura Electric Co., Ltd. (Toshiba)	4.1	3.6
Oki Electric Industry Co., Ltd.	4.0	3.3
Mitsubishi Electric Corp.	1.6	1.4
	93.1	93.2

Fujitsu is the only manufacturer in Japan to design a computer without relying on foreign technology. The other producers developed their computers and related machinery through licensing agreements with U.S. firms, particularly Honeywell Information Systems, General Electric, Sperry Rand, Westinghouse, Xerox Data Systems, and RCA. All of the Japanese computer producers entered into technical licensing agreements with overseas computer manufacturers between 1960

Table 3.—Value of production of the Japanese computer and related equipment industry by type of equipment, 1969-72

(in millions of U.S. dollars)

	1969	1971	1972
Analog computers	4.3	5.8	5.7
Digital computers	474.0	864.3	1,144.2
Computer peripheral equipment	16.5	28.4	37.9
Other related equipment ..	49.6	63.4	71.7
Total	544.4	961.9	1,259.5

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

and 1964. By 1972, they had concluded 86 such contracts, 75 of them with U.S. firms.

Fujitsu now uses IC's in all its computer circuitry, while Hitachi and other makers will replace magnetic core elements with IC's on a model-by-model basis over the next 2 years. Multilayer ceramic capacitors are being used for hybrid IC's in computers, and liquid crystals are expected to become important in the near future for character displays.

The three major manufacturers, Fujitsu, NEC, and Hitachi, plan to escalate their foreign sales and expect to increase plant capacity to meet their international sales goals. Fujitsu and Hitachi expect to continue their dominance of the mainframe market, while NEC will specialize in computer-related communications equipment. Other manufacturers are expected to cut back severely on CPU production and specialize in terminal and peripheral equipment.

Industry sources expect investment for the production of hardware systems to remain steady over the next 5 years. The rising demand for software is expected to lead thereafter to a shift in investments to software production. Fujitsu plans to spend \$20.4 million for a new factory at Numazu (Shizuoka Prefecture) for computer production, and is purchasing land for another plant in Tochigi Prefecture to produce other electronic products.

Capital investments in 1974 by the three major computer manufacturers are expected to approximate \$50 million for Fujitsu, \$35 million for NEC, and \$20 to \$30 million for computer-related investments by Hitachi. Hitachi expects its investments to rise 20 to 30% annually between 1973 and 1975.

The level of vertical integration in the Japanese computer industry is high when compared to industrial counterparts in the United States. In most cases, the top six computer manufacturers obtain components from their own subsidiary producers or from smaller component manufacturers affiliated through banking relationships. The major exception is in the field of sophisticated components,

such as computer memory IC's, which are imported.

Consumer products sector.—Japan had more than 3,000 firms with a total of about 270,000 employees producing consumer electronic goods in 1972. Total output reached \$5.1 billion in 1972 and is predicted to exceed \$7.5 billion in 1977. Capital investments by the consumer electronic products manufacturers in 1973 climbed to nearly \$150 million, more than double the 1972 outlay of \$73.6 million.

TV receivers accounted for \$2.5 billion, or 29% of Japan's 1972 total output of electronic end products, and tape recorders represented \$916 million, or 11% of the total. High growth rates were exhibited in the output of FM tuners, which grew an average 39% annually between 1969 and 1972, and hi-fi amplifiers, which rose at an average rate of 36% annually during the same period.

Electronic calculators.—The fastest growing segment of the consumer products sector is the electronic desk-top and pocket calculator industry. Production increased from \$32 million in 1967 to \$355 million in 1972, representing a 60% average annual growth rate over the 5-year period. Exports rose from \$9 million in 1967 to \$236 million in 1972, an average annual increase of more than 90%.

Nearly 50% of the exported calculators were shipped to the United States in 1972; about 20% were sold to European Economic Community (EEC) countries; and 7% were exported to Canada and the United Kingdom.

The overseas market for Japanese calculators expanded so rapidly that manufacturers were unable to organize sales networks. Consequently, foreign sales under the buyer's brand name are common. Sharp calculators, for example, are sold in the United States under the Burroughs name, Canon calculators under the name of Monroe, and Hitachi calculators under the Frieden label.

The Japanese pocket calculator industry comprises 16 firms; 7 of these firms make a variety of electrical equipment and produce other types of merchandise (e.g., Canon makes calculators and cameras). Some 15,000 persons are employed in the manufacture or assembly of calculators. The major companies, their production capacity, and their share of the domestic market as of December 1973, are as follows:

	Production/ month (units)	Market share (percent)
Sharp Corp.	300,000	28
Casio Computer Co., Ltd.	300,000	28
Canon, Inc.	120,000	11
Eiko Business Machine	100,000	9
Sanyo Electric Co., Ltd.	70,000	6
Ricoh Co., Ltd.	50,000	5
Total	940,000	87

Three companies signed licensing agreements with U.S. firms in 1969 for the manufacture of desk-top or pocket calculators: Nippon Calculating Machine Corp. (Busicom) was licensed by Wyle Laboratories; Yokogawa Hewlett-Packard by Hewlett-Packard; and Canon, Inc., by Texas Instruments, Inc. Commodore Japan, Ltd., a subsidiary of the U.S. firm Commodore International, Ltd., produces desk-top calculators. Approximately 98% of the firm's production is exported to the United States.

Sharp Corp. developed the world's first electronic desk-top calculator in 1964. This transistorized solid state calculator, called COMPET CS-10A, proved superior to electric calculators in both speed and noise level and gave Japan an early lead in the world market for electronic calculators.

Casio Computer introduced a low-priced, personal desk-top calculator, "Casio Mini," in May 1972. Busicom, Omron Tateishi, and Citizen Watch Co., Ltd., followed with similar products, and Sharp, in June 1973, announced a new lower-priced model.

Most manufacturers of Japanese desk-top calculators are increasing their production capacity, although some minor producers have either withdrawn from the market or cut back production, due to increased costs of materials.

Practically all Japanese-made calculators utilize LSI circuitry. Some of the large electric equipment firms are supplied with electronic components manufactured in-house or by affiliated subsidiaries in their group. Other producers, however, are purchasing from outside vendors. Calculator manufacturers who produce LSI's are expanding production for their own use and also for sale to other assemblers.

Japanese calculator manufacturers are now concentrating their efforts on miniaturizing parts and integrating them. Sharp Corp. developed the COS (calculator on substrate) system for calculators in May 1973. This system integrates such parts as the display panel, drive system, and key connection on a single glass plate. Sharp's new calculator, called the "EL-809," also uses a liquid crystal display device.

Matsushita Electronics developed a single chip LSI for 16-digit calculators which integrates 11,000 transistors on a 5.9 millimeter square semiconductor. This chip can replace six LSI's and nine other IC's. Hitachi is producing aluminum and silicon gate LSI's (P- and N-type) and Ion plantation silicon gate C/MOS's. It also is developing an SOS (silicon on sapphire) LSI.

The use of LED's in calculator displays has been gradually increasing. Roughly 10% of the calculators produced in 1972 had LED displays, while in 1973 nearly 20% had LED's. However, 90% of the LED displays are red, and Japanese manufacturers are seeking to develop a GaP LED with a green display. Toshiba has developed mass pro-

duction technologies for the GaP LED, and Hitachi and NEC aim to shift from Ga AsP to GaP LED. There still are problems in mass production technologies and production costs, however, and commercialization probably will be delayed until 1974 or 1975.

Busicom and Sharp displayed liquid crystal calculators in the 1972 and 1973 Business Machine Shows in Japan. Sharp developed TN type liquid crystal with Dainippon Ink and Chemical, Inc., and in May 1973 introduced a liquid crystal display calculator called the EL-805 (8-digit). However, further development of liquid crystal technology is necessary to resolve the present problems regarding reliability and legibility. Real commercialization of liquid crystal for desk-top calculator use may not occur until after 1975.

Competitive Environment

Japanese production of the electronic components under review totaled \$2.5 billion in 1973, representing an average increase of 40% a year from the 1971 production level. Output is expected to grow at a slower rate—about 8% per year—between 1973 and 1977. Annual domestic production of these components is forecast to reach \$3.4 billion in 1977.

Past growth in the domestic electronic components industry stemmed largely from technical licensing agreements with foreign firms, most often with U.S. manufacturers. Between 1945 and 1971, Japanese producers concluded 177 licensing agreements in the semiconductor and IC fields; 154 agreements regarding connectors, capacitors, resistors, switches, inductors, etc.; and 48 agreements concerning electron tubes. About 85% of these technical licensing arrangements were with U.S. corporations.

The Japanese electronic component industry started in the late 1950's in small private factories. By 1969, there were 6,000 component manufacturers, with a total of 342,000 employees. The industry today consists of two groups of companies—the companies that specialize in the manufacture of electronic components and the OEM's who make components for use in their electronic end products.

The OEM group consists of such giant electrical firms as Hitachi, Ltd.; Toshiba Components Co., Ltd.; Matsushita; Mitsubishi Electronic Corp.; Sanyo Electric Co., Ltd.; and Sony Corp.

When the demand for electronic goods started to climb in the 1950's, the OEM's began to manufacture components to partially fill their own needs, acquiring technology through licensing. They rose to a strong leadership position in the components industry because of their financial, marketing, and technological strength. However, the OEM's were unable to produce all the components they needed

and gradually formed subsidiary networks of component manufacturers such as Teikoko Tsushin Kogyo Co., Ltd.; Alps Electric Co., Ltd.; Tokyo Cosmos Electric Co., Ltd.; Nichicon Capacitor, Ltd.; Maruon Electronics Co., Ltd.; Matsuo Electric Co., Ltd.; Taiyo Yuden Co., Ltd.; and Hirose Electric Co., Ltd.

The current trend is for Japanese producers of electronic components to shift their production facilities to developing countries in the Far East and South America. This change has been necessitated by the rise in Japanese wages (20% higher in 1973 than in 1972) and the 15% annual increases in industrial land values. The manufacturing subsidiaries of Japanese firms in Taiwan and Korea are now serving as a supply base for less sophisticated components for their parent companies in Japan.

Total Japanese exports of the electronic components surveyed grew an average of 65% annually between 1971 and 1973, reaching \$268.6 million. The rate of export growth is forecast to decline sharply between 1973 and 1977, as Japanese firms are expected to fill an increasing number of foreign orders from the output of their overseas factories.

Electronic component technology in Japan lags 1 to 2 years behind that of the United States. The structure of the Japanese electronics industry is such that innovation comes from the OEM instead of the component manufacturer, who is essentially in the position of filling orders rather than developing product lines.

Efforts to develop new items typically begin after a foreign originator has marketed a product and proved its commercial success. This practice is not likely to change. The government's announced R&D budget in the electronics field for 1971-77 included only 10% for components—4% for parts for circuits, printing of circuits, and components; 4% for integrated circuits; 1% for electron tubes; and 1% for semiconductor elements.

U.S.-Japan joint-venture companies have been established to supply components that are in local demand and that require highly sophisticated technologies, such as integrated circuits. Such components are usually in short supply in Japan. Less than 1% of the total production of such companies is exported to the United States, and exports to third countries are even smaller.

Integrated circuits.—The development of solid state computer memories demonstrates the technological disparity between the United States and Japan. Japan is roughly 1 to 2 years behind the United States in MOS Random Access Memories (RAM). The U.S. market for 1,024-bit memories has been firmly established, and 4,096-bit memories have been developed and marketed. Hitachi recently developed the technology for 4,096-bit N-MOS mem-

ories, and Fujitsu has developed a 2,048-bit memory, but neither Japanese company has commercialized these products.

The discrepancy between Japanese and American technology in IC's arises partly from the shortage of R&D funds for basic research currently available to Japanese component manufacturers. Another major factor is the small market for IC's in Japan compared to the United States, making it less feasible economically for manufacturers to tool up for new technology product lines. Japanese producers also are reluctant to develop products if they cannot foresee steadily rising future sales volumes.

Values of Japanese production of IC's in 1973, by type, follow in millions of U.S. dollars.

Semiconductor IC's	
linear	95
bipolar	85
MOS	142
Hybrid IC's	
thin film	17
thick film	46

There were 15 firms producing IC's in Japan in 1973, three of them U.S. subsidiaries. Production of IC's is expected to increase an average of nearly 25% annually between 1973 and 1977, climbing from \$384.5 million to over \$900 million. OEM's account for almost 90% of total IC production. The aggregate IC production of Nippon Texas Instruments and TDK-Fairchild (U.S. subsidiaries) reached an estimated \$30 million in 1972. The output of Kyodo Denshi, the only Japanese-owned electronic component manufacturer that does not also produce equipment, totaled about \$3.8 million in 1973.

Japanese IC manufacturers are making major investments in advanced componentry production, focusing on IC's and N-Channel MOS devices. Nippon Electric Corp. (NEC) has established a new subsidiary in Kyushu with production facilities for MOS's and LSI's. New equipment to make IC memories and C/MOS circuits was purchased by NEC in late 1973.

Fujitsu invested \$18.9 million in equipment for IC production in 1973 and expects its annual increase in investment for IC and IC-related production to average 25 to 35% for the next several years. Fujitsu is expanding its main IC factory in Aizu and plans to purchase new production equipment for its Kawasaki plant.

Toshiba is investing \$3.7 million to increase production in its IC plant at Oita from 2.5 million IC's per month to 5 million per month by July 1974.

C/MOS producers are competing to participate in the newly emerging electronic watch industry market. Hitachi and Oki were the first to market C/MOS IC's. Toshiba, NEC, Mitsubishi, and Kyodo entered the market at the end of 1973. About 20 firms probably will produce C/MOS's in 1974, in-

cluding 3 U.S. subsidiaries—Texas Instruments, Motorola, and RCA.

Testing equipment has been and will continue to be a major problem for domestic producers of advanced circuitry in Japan. Several firms have gone heavily into the field, only to find their production progress blocked in the testing phase. Until this technological problem can be dealt with, electronics manufacturers will continue to rely on foreign sources for highly specialized components.

Color TV picture tubes.—All color TV picture tubes used in Japan are produced by Japanese equipment manufacturers. The approximate market shares of the leading producers are Toshiba, 30%; Matsushita, 25%; Hitachi, 23%; Sony, 10%; NEC, 6%; and Mitsubishi, 6%. Japanese manufacturers are actively pursuing development of CRT's with 90° to 100° deflection and black matrix systems. Toshiba has already commercialized its "Hi-bright Matrix Color CRT" using a black background method. Mitsubishi started to mass produce 110° deflection CRT's in 1972, and Sony has developed the first wide-angle 114° deflection color CRT made in Japan.

Problems regarding color gap and production costs have slowed development of black matrix 110° deflection CRT's, but Toshiba, Hitachi, and Matsushita recently found techniques to overcome these problems.

Resistors.—Local production of resistors increased at an average annual rate of 39% between 1971 and 1973, rising from \$176.8 to \$341.7 million. The average annual rate of production growth is forecast to decline sharply to 9% during the next 4 years, as many Japanese resistor manufacturers will be investing in developing countries for production of these components.

Japanese output of wirewound resistors grew from \$9 million in 1969 to \$22 million in 1973, while metal film resistor output rose from \$6 to \$15 million. All the leading resistor producers are licensees of U.S. firms and include Koa Denko Co., Ltd.; Tama Electric Co., Ltd.; Hokuriku Electric Industrial Co., Ltd.; and Tokyo Cosmos Electric Co., Ltd. The major OEM's who also make resistors are Matsushita Electric Industrial Co., Ltd., and Alps Kenki Co.

Capacitors.—About 25% of the total \$138-million output of aluminum electrolytic capacitors in 1972 was produced by Matsushita Electric Industrial Co., Ltd.

Elna Co., Ltd., produced about 18% of the total; Nichicon Capacitor, Ltd., 16%; Marucon Electronics Co., Ltd., about 14%; and Hitachi Condenser Co., Ltd., 8%.

Production of tantalum electrolytic capacitors reached \$19 million in 1972, with 40% provided by NEC and 12% by Fujitsu, Ltd.

Total output of ceramic capacitors reached \$79 million in 1972. The approximate 1972 market shares of leading manufacturers of ceramic capacitors were TDK Electronics Co., Ltd., 24%; Murata Manufacturing Co., Ltd., 22%; Matsushita Electric Industrial Co., Ltd., 18%; and Taiyo Yuden Co., Ltd., 15%.

Transistors.—Nearly 90% of the transistors produced in Japan are made by OEM's. The major manufacturers of transistors include Hitachi, which accounted for 21% of the \$296-million transistor output in 1972; Toshiba, 19%; Matsushita Electronics Corp., 15%; and Mitsubishi, 19%.

Production of germanium transistors is decreasing, but silicon transistor output is still growing. Sony has developed a power field effect transistor (FET) and has built facilities capable of producing 20,000 such transistors per month.

The outlook for domestic demand for all but specialized transistors is generally pessimistic because of the development of IC's, and slow growth in production is expected until 1975. Output then is forecast to decline.

Connectors.—Production of connectors reached \$48 million in 1972. Two U.S. licensees, Nippon Avionics Co., Ltd., and Daiichi Denshi Kogyo Co., Ltd., accounted for 54% of this output. Hirose Electric Co., Ltd. had 22% of connector output. Other firms making connectors include Nippon AMP Co., a wholly owned U.S. firm, and two U.S.-Japan joint venture companies, Nippon Burndy Co. (Burndy Corp.) and Mitsumi Shinchi (United Carr, Inc.).

Diodes and rectifiers.—Electronic end-product manufacturers make 90% of the diodes they use and 40% of the rectifiers. Hitachi, Toshiba, and some of the other equipment producers are able to supply approximately 60% of their own requirements. Rectifier production is expected to increase at an average of about 7% annually between 1974 and 1977, but diode production probably will decrease by an average of 5% yearly during this period, due to wider use of IC's.

Component production plants expanding.—The major electronic component manufacturers are expanding their production facilities or investing in equipment to upgrade their production capability. Hitachi invested an estimated \$11 to \$15 million in 1973 to expand its semiconductor production. The investment was expected to raise the value of its semiconductor sales to about \$190 million yearly.

NEC in 1964 began to decentralize its production facilities and to establish new subsidiaries in widely scattered localities. These plants included Yamagata-NEC for transistor production, Kagoshima-NEC for display tubes, and Hyogo-NEC for lead switches. At a cost of \$11.3 million, NEC in 1973 set up Toyama-NEC to produce condensers

and variable resistors. The establishment of Toyama-NEC completed the plant decentralization plan, and NEC now will concentrate on investing in production facilities for new products and modernization of existing plants.

Fujitsu planned to invest about \$29 million for electronic component production facilities in the 1973-74 period, and Toshiba spent about \$30 million for the same purpose in 1973.

Foreign suppliers are numerous.—U.S. suppliers who have successfully entered the expanding Japanese electronic components market include Burr-Brown Research Corp., Collins Radio Co., General Instrument Corp., and Intel Corp. (IC's); and Analog Devices, Inc., Crystalonics Div. of Teledyne Co., and Teledyne Semiconductor (field effect transistors).

Also, Dale Electronics, Inc. (resistors); Thomas Electronics, Inc. (CRT's); Varo Semiconductor, Inc. (rectifiers); Fairchild Semiconductor (semiconductors and IC's); Solitron Devices, Inc. (diode transistor rectifiers and IC's); Laser Diode Laboratory, Inc. (laser diodes); and Monsanto Co. (light emitting diode indicators, displays and visible arrays, and other products).

Other foreign suppliers include Allgemenie Elektrizitatets Gesellschaft and AEG Telefunken of Germany, Thomson-CSF of France (electron tubes), GE/TI/ECC/Microsystem of Canada, and SGS-ATES of Italy (transistors, diodes, and IC's). Terminals and connectors are supplied by AMP Inc. (U.S.) subsidiaries in France, Germany, Italy, The Netherlands and the United Kingdom.

Duties and trade restrictions.—Japanese customs duties range from 6 to 12% for electronic components. Exporters should investigate specific rates since there are some variables. For example, IC's imported uncased are dutiable at 8% but dutiable at 12% if imported cased. The definition of cased depends on the type of IC.

Information on official duty rates applicable to specific products within the product category may be obtained from the U.S. Department of Commerce, Domestic and International Business Administration, Room 4217, Main Commerce, Washington, D.C. 20230.

Any IC that contains 200 or more elements (i.e., individual diodes, transistors, resistors, capacitors, etc.) cannot be imported without obtaining prior approval from the Ministry of International Trade and Industry. Approval is based on import quotas that are set every 6 months for importers; approval usually is granted for those with an established record of importing IC's.

Technical Requirements

Electric power in Japan is supplied through low-voltage lines, providing 100-volt, single-phase or

200-volt, 3-phase electricity; or through high-voltage lines of either 3,000 or 6,000 volts, 3-phase. Some larger plants and buildings may be supplied by 10,000- or 20,000-volt lines. Electrical frequency is 50 hertz in northern Japan, including Tokyo, and 60 hertz in the rest of the country.

Japanese law permits the use of only the metric system for measurement and calibration.

Published national standards for electronic components in Japan may be obtained through the American National Standards Institute, Inc., 1430 Broadway, New York, N.Y. 10018.

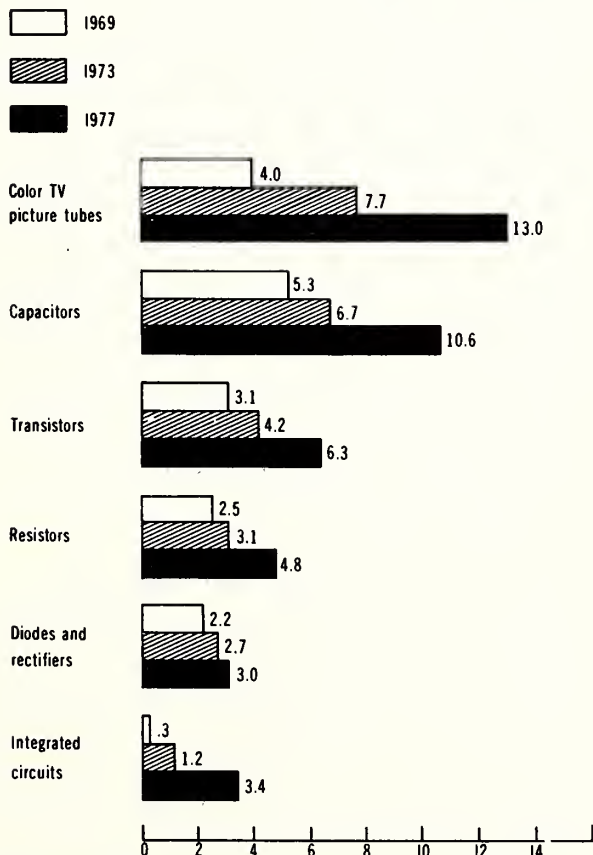
The following market research study, upon which this Country Market Survey is based, is available on loan from the U.S. Department of Commerce, Domestic and International Business Administration, Room 1617M, Main Commerce, Washington, D.C. 20230:

"The Market for Electronic Components in Japan,"
DIB 74-04-504, October 1973.

Mexico

Mexico's market¹ for the selected groups of electronic components covered in this survey is expected to expand at an average annual rate of 12.6% over the 1973-77 period. Sales in 1977 should reach over \$40 million, compared with \$18.7 million in 1971 and \$25.6 million in 1973 (see table 1). Steadily rising consumer demand for television sets and stereophonic sound equipment, coupled with heightened industry interest in developing export markets, will contribute to increased sales of electronic components.

Mexico: Size of market for selected groups of electronic components, 1969-77
(in millions of U.S. dollars)



Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

Imports averaged 17% of the total Mexican market for product category components during the 1971-73 period. Purchases from foreign suppliers went up 57%, from \$2.8 million in 1971 to \$4.4 million in 1973. Predicted increases averaging in excess of 10% annually would raise imports to \$6.6 million in 1977. Specialized items that domestic manufacturers find unprofitable to produce will contribute to the bulk of this growth.

American exporters supplied 46% of Mexico's import market for product category components in 1972, recording sales of almost \$2 million (see table 2.)

The U.S. share should continue to be close to 50% during the 1974-77 period. The predominance of U.S. manufacturing subsidiaries and licensees in all sectors of Mexico's electronics industry is the basic factor favoring continued U.S. leadership in this market. The source and type of electronic components imported by the various manufacturers is determined almost entirely by their affiliation with overseas electronics firms. Mexican subsidiaries and

¹ This survey excludes discussion of Mexico's "border industries." Goods are imported by factories in Mexico, held in bond for assembly and/or further manufacture, and re-exported without officially entering the country.

Product Category Definition

Electronic components covered in this survey are basically confined to resistors, capacitors, color TV picture tubes, diodes and rectifiers, transistors, and integrated circuits.

The term "product category" as used in this publication is limited to these six groups of components.

**Mexico—Selected Indicators
(1972)**

Gross domestic product:	\$41.2 billion
Population:	53 million (est.)
Total country imports:	\$2.9 billion
Imports from U.S. (w/share of total):	\$1.8 billion (60%)
Total country exports:	\$1.8 billion
Exports to U.S. (w/share of total):	\$1.1 billion (62%)
Exchange rate (May 1974):	12.48 pesos=US\$1

licensees of U.S. electronics manufacturers, for example, account for 95% or more of the country's imports of American-made components.

Sales Opportunities

Mexico's manufacturers of electronic end-products are expected to consume nearly \$139 million worth of product category components during the 1974-77 period. Imports are expected to account for approximately \$27 million of this total.

A market research survey recently conducted in Mexico for the U.S. Department of Commerce, Office of International Marketing reveals that favorable sales opportunities exist for American exporters of the following electronic components:

Resistors.—The United States exported more than \$500,000 worth of resistors to Mexico in 1972, supplying 40% of the import market.

The market for resistors, keeping pace with the steady growth of Mexico's electronics industry, should approach \$5 million in 1977, compared with over \$3 million in 1973. Most domestically produced resistors are designed for use in the manufacture of consumer products, particularly television sets and radios. Makers of precision instruments, telecommunications equipment, and other specialized industrial/commercial electronic equipment require resistors of closer tolerances, higher quality, greater reliability, and more advanced design than those available from domestic producers. Consequently, Mexican dependence on foreign suppliers of resistors is expected to continue at 35 to 40% of consumption during the 1974-77 period. Fixed composition, fixed film, fixed wirewound, and variable wirewound resistors are expected to offer the best sales prospects.

Transistors.—Approximately 20% of the transistors purchased by Mexico's electronics industry are obtained from foreign sources, principally the United States. American transistors accounted for 1972 purchases totaling \$384,000, or 62% of the import market. As consumption rises from the 1973

level of \$4.2 million to a projected \$6.3 million in 1977, Mexican dependence on imported transistors is expected to continue at the current level. Taking advantage of liberalized trade regulations within the Latin American Free Trade Association (LAFTA),² leading multinational corporations currently supply their Mexican subsidiaries from their plants in other LAFTA member countries. The Mexican market will nevertheless continue to hold good potential for advanced U.S.-made silicon transistors for specialized applications.

Diodes and rectifiers.—The electronics industry's consumption of diodes and rectifiers, estimated at \$2.7 million in 1973, may only reach \$3 million in 1977. The growth of the market has been slowed by the increasing utilization of integrated circuits. However, imports should continue to supply one-third of the market, providing opportunities for American suppliers of power rectifiers, silicon diodes, zener diodes, LED's, and other special types of diodes. U.S.-made components accounted for 58%—or almost \$563,000 worth—of Mexico's 1972 purchases of imported diodes and rectifiers.

Integrated circuits.—IC's were first manufactured in Mexico in 1970 but the quantities produced to date are small. Demand—especially for hybrid IC's—should increase sharply during the 1974-77 period. Consumption should exceed \$3.4 million in 1977, compared to \$1.2 million in 1973. It is expected that Mexican component manufacturers will be hard-pressed to satisfy the demand for the full range of specialized types of IC's. IC imports, of which U.S. suppliers accounted for approximately 76% in 1972, should more than double their 1973 level, reaching over \$1 million in 1977.

Other electronic components.—A good growth market for miscellaneous electron tubes outside the product category is emerging in Mexico. U.S. exporters provide most of Mexico's requirements for transmitting, industrial, and special-purpose tubes, as well as gas vapor tubes such as thyratrons, photo tubes, and diode rectifiers. The United States should continue to fill the bulk of the demand for these items during the 1974-77 period.

Selected End-User Industries

Mexico's electronics industry was developed by leading United States, German, Dutch and, more recently, Japanese manufacturers, and few companies are entirely Mexican-owned. The great majority are wholly owned subsidiaries or licensee/joint ventures of well-established international firms. Although Government policies have brought about a greater participation of Mexican capital and have

² LAFTA member countries are: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico, Paraguay, Peru, Uruguay, and Venezuela.

led to the development of managerial skills among Mexican personnel, the industry still draws extensively on foreign technology.

Mexico's electronics industry comprises an estimated 200 firms, most of which produce several lines of equipment. Data gathered by Mexico's Department of Industry and Commerce indicate that, in 1970: A total of 84 firms were making television, radio, and audio equipment; 33 were producing other electronic equipment and apparatus; and 181 were manufacturing parts and accessories, including product category components. The 12 largest electronics manufacturers, each employing more than 500 workers, accounted for slightly more than 50% of the industry's total production, which was estimated to have exceeded \$270 million in 1970.

The Mexican Government gives high priority to the further development of all sectors of the country's industry, including the electronics products industry. Under official aegis, production facilities are being modernized, and manufacturers are beginning to locate in areas outside the excessively developed Distrito Federal (Mexico City). Tax incentives, ranging from partial to complete waiver, have been the Government's principal means of accomplishing these aims. Recipient firms must meet certain requirements as to the degree of Mexican ownership (51% minimum), the percentage of capital investment funds to be spent within Mexico (60% minimum), and the sums to be paid to foreign sources for royalties, trademarks, and technological assistance. In addition, automatic tax credits of 11 to 14% on the f.o.b. factory value of exported goods are granted to exporters of approved products, which include most finished electronic products and components.

Despite official encouragement and assistance, Mexico's electronics manufacturers have not found it practical to try to keep pace with rapidly changing electronic technology. Management is competent but its largely oriented toward the solution of short-term problems. It therefore does not typically engage in long-term planning and spends little on research and development. Furthermore, electronics manufacturers feel that the size of the market for their products does not warrant frequent heavy investments in production equipment. Hence, innovations are introduced gradually and only as dictated by the product designs supplied by their foreign licensors. Furthermore, the availability at modest cost of workers who, once trained, are capable and productive, has held back automation of the country's production processes.

Consumer products sector.—The consumer products sector of Mexico's electronics industry is by far the largest market for electronic components, accounting for at least 80% of product category component consumption. Unit sales of the major elec-

Mexico—The Electronics Industry Basic Data (1972)

Total value of production (1970 est.):	\$270 million
Number of manufacturers (1970 est.):	200
Industry labor force (1970 est.):	30,000
Output by quantity of principal electronic components user industries—	
Consumer products industries:	
television receivers	444,377 units
car radios	169,540 units
other radios	729,527 units
tape recorders	10,355 units
portable record players	63,336 units
juke boxes	2,498 units
Industrial/commercial equipment industries:	
desk calculators	10,000 units
automotive alternators	156,000 units
automotive voltage regulators	120,000 units

tronics items totaled 1.4 million in 1972 and should exceed 2 million in 1977. An average annual growth rate of 12% in sales volume is projected for 1973-77, with the most rapid expansion taking place in 1974. The industry seems to have recovered from the setback it suffered in 1971 when the Government raised the excise tax on manufacturers of consumer electronics products from 3 to 10% and imposed an additional 10% excise tax at the retail level. Strong industry protest, accompanied by drastic drops in both production and sales of the affected products, forced the Government to rescind the additional taxes in 1972.

The growing purchasing power of the Mexican worker and the steady expansion of the middle-class population lead market analysts to predict marked increases in production and sales of color television sets and audio equipment. The historical and projected future trends in unit sales of the major consumer electronics products are illustrated in table 3.

A limited number of hand-held electronic calculators are now being produced in Mexico. However, this production is meeting stiff competition from imported calculators, notably those produced in bond by the "border industries," and will probably be suspended.

Television industry.—Color TV broadcasting in Mexico was inaugurated in 1967 and domestic manufacturers produced 8,200 sets in that year. Color TV sales have risen rapidly since then, to-

Table 1.—Mexico: Size of market¹ for selected groups of electronic components, 1969-77
(in millions of U.S. dollars)

Description	1969	1971	1972	1973	1974	1977
<i>Resistors</i>						
Production ²	1.5	1.7	1.6	1.8	2.1	2.9
Imports	1.1	.8	1.3	1.4	1.5	2.1
Exports .....	.1	.1	.1	.2	.2	.2
Market size	2.5	2.4	2.7	3.1	3.4	4.8
<i>Capacitors</i>						
Production ²	5.1	5.4	5.7	6.4	7.2	10.1
Imports .....	.5	.5	.7	.8	.9	1.3
Exports .....	.3	.4	.5	.5	.6	.8
Market size	5.3	5.6	6.0	6.7	7.5	10.6
<i>Color TV picture tubes</i>						
Production ²	3.7	4.8	6.7	8.9	10.3	15.5
Imports .....	.3	.2	.2	.1	.1	—
Exports	—	.4	.8	1.3	1.6	2.5
Market size	4.0	4.6	6.1	7.7	8.8	13.0
<i>Diodes and rectifiers</i>						
Production ²	1.6	2.1	1.8	2.0	2.0	2.1
Imports .....	.7	.5	1.0	.9	.9	1.0
Exports .....	.1	.1	.1	.1	.1	.1
Market size	2.2	2.5	2.6	2.7	2.7	3.0
<i>Transistors</i>						
Production ²	2.7	3.0	3.2	3.7	4.0	5.5
Imports .....	.6	.5	.6	.7	.8	1.1
Exports .....	.2	.2	.2	.2	.2	.3
Market size	3.1	3.3	3.6	4.2	4.6	6.3
<i>Integrated circuits</i>						
Production ²	—	*	.5	.7	.9	2.4
Imports	—	.3	.4	.5	.6	1.1
Exports	—	—	*	*	*	.1
Market size	—	.4	.9	1.2	1.5	3.4
<i>Totals</i>						
Production ²	14.6	17.0	19.5	23.5	26.5	38.5
Imports	3.2	2.8	4.2	4.4	4.8	6.6
Exports .....	.7	1.2	1.8	2.3	2.8	4.0
Market size	17.1	18.7	21.9	25.6	28.5	41.1

¹ Size of market equals production plus imports minus exports. Parts and accessories not included.

² Production figures do not include components manufactured by OEM's for their own use.

* Less than \$50,000.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

taling 42,500 units in 1973. This figure will probably double by 1977. Nevertheless, because of the relatively low per-capita income of the Mexican consumer, black-and-white sets continue to dominate the market. More than 400,000 such sets, having a total value of over \$80 million, were sold in 1972. Sales should approach 600,000 sets in 1977, reflecting an average annual growth rate of approximately 8.5%.

Seven major subsidiaries or licensees of foreign firms are engaged in the manufacture of TV sets in Mexico. These companies are: Admiral de Mexico, S.A. de C.V.; General Electric de Mexico, S.A.; Philco, S.A. de C.V.; Construcciones Electronicas, S.A. (Magnavox); Telefunken Mexicana, S.A. de C.V.; and Television del Distrito Federal, S.A. (Hitachi). Together, Admiral, General Electric, and

Philco account for roughly 50% of the market.

All color TV sets made in Mexico employ hybrid circuitry. Only 15% of monochrome sets are fully transistorized, 55% are hybrid, and 30% use no transistors at all. No significant changes in this technological pattern are expected to occur during the 1974-77 period.

Vertical integration within the Mexican television set industry is confined mainly to the manufacture of parts and accessories, such as tuners, yokes, fly-back transformers, and coils. Despite the difficulties arising from their dependence on a single source of supply, none of the firms plans production of resistors, capacitors, or other product category components. Both Television del Distrito Federal and Philips Mexicana, S.A., however, obtain part of their requirements for such components from Mexi-

can firms affiliated with their parent corporations.

Industrial/commercial equipment sector.—The auto industry is the major user of product category components in Mexico's industrial/commercial equipment sector. Its purchases of diodes and transistors for use in automotive alternators and voltage regulators are expected to exceed \$1 million in 1977, compared with \$630,000 in 1972. Other industrial users of electronic components include the makers of desk calculators, certain telephone equipment, and juke boxes. Together with the auto industry, these manufacturers account for an estimated 20% of Mexico's consumption of product category components. Computers, electronic telecommunications equipment, electronic measuring and testing equipment, and medical electronic equipment—all of which are in high demand in Mexico—are usually imported as finished products.

Automotive industry.—Seven of the world's leading automobile manufacturers produce motor vehicles in Mexico. They are: American Motors, Chrysler Corporation, Ford Motor Co., and General Motors, all of the United States; Renault of France; Volkswagen of Germany; and Datsun of Japan. New vehicle sales, which totaled 233,437 automobiles in 1972, are expected to rise to 420,500 in 1977.

The auto industry's use of electronic components, now limited to those types of transistors and diodes needed for alternators and voltage regulators, should increase markedly when Mexican production of electronic ignition systems begins in 1976. Trade sources estimate that output of these systems, now being imported by Chrysler as finished products, could amount to 145,000 units in 1977.

Two firms—Industria Electrica Automotriz, S.A., and Corporacion de Radio, S.A.—make most of the alternators and other electronic devices required by Mexico's auto industry. Both companies are controlled by the same Mexican financial interests and receive technical support from the U.S. firms, Auto-

lite and Motorola, respectively. They buy electronic components from Mexican affiliates of Motorola, Toshiba (Japan), and Fairchild Camera and Instrument (U.S.). Chrysler purchased the bulk of the 120,000 voltage regulators produced by the two companies in 1972.

The Competitive Environment

Mexico's electronic component manufacturing sector represents one of the country's fastest-growing industries, chiefly because Government protectionist policies have encouraged equipment producers to use domestically made components to the fullest extent possible in meeting the strong demand for consumer and other electronic products. Production of product category components, valued at \$14.6 million in 1969, rose to \$23.5 million in 1973. Output is expected to increase at an average annual rate of more than 13% during the 1973-77 period, exceeding \$38 million in the latter year.

Manufacturers of color TV picture tubes, integrated circuits, and transistors were responsible for the greatest increases in domestic production. Forecasts for the 1973-77 period suggest that output of IC's will show an average annual growth rate of 36%, while production of color TV tubes, resistors, capacitors, and transistors is expected to rise by 10 to 15% annually. Output of diodes and rectifiers is likely to continue near the 1971 level of \$2.1 million.

In addition to meeting strong domestic demand, Mexico's electronic component industry succeeded in increasing its exports of product category components from \$1.2 million in 1971 to \$2.3 million in 1973. The tax incentives referred to earlier, along with further reductions in trade barriers between LAFTA member nations, should boost exports to \$4 million in 1977. Export demand for Mexican color TV tubes and capacitors is expected to be particularly strong. Manufacturers expect to ship \$2.5 million worth of color TV tubes and \$800,000

Table 2.—Mexico: Imports from the United States, and U.S. share of total imports, of selected groups of electronic components, 1969-72¹
(in thousands of U.S. dollars)

Description	1969		1971		1972	
	Value	U.S. share (percent)	Value	U.S. share (percent)	Value	U.S. share (percent)
Resistors	518	46	467	57	509	40
Capacitors	88	20	116	22	71	10
Color TV picture tubes	171	68	107	65	88	53
Diodes and rectifiers	582	79	338	67	563	58
Transistors	401	69	375	82	384	62
Integrated circuits	—	—	304	91	308	76
Total	1,760	56	1,707	61	1,923	46

¹ Parts and accessories not included. Also excludes shipments from the United States to the "border industries" when such goods are held in bond for manufacturer's use and re-export.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

Table 3.—Mexico: Sales of consumer electronic products, in units, 1969, 1972, and projected 1977

	1969	1972	1977
Monochrome TV sets	360,208	401,930	588,406
Color TV sets	43,160	42,447	96,300
High fidelity and/or stereo consoles	135,164	170,947	362,900
Stereophonic audio equipment w/cabinet	10,931	21,599	89,400
Tape recorders	6,851	10,355	24,000
Portable record players ..	66,091	63,336	65,000
Radios, other than automobile	630,221	536,981	500,000
Car radios	132,100	169,540	280,000

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

worth of capacitors to foreign customers in 1977.

Fourteen manufacturers are engaged in the production of electronic components in Mexico. Among the most important in terms of range of components marketed are subsidiaries of Fairchild Semiconductor Inc., Philips, and Toshiba. Four firms account for most of Mexico's output of resistors, both fixed and variable, including carbon, film, and wirewound. Fixed capacitors—the only type produced in Mexico—are made by six companies under license from Philips, Sprague Electric Co., and Zenith, among others. Both resistor and capacitor manufacturers import substantial quantities of raw materials such as wire, ceramic powders, and mylar insulating material.

Subsidiaries and licensees of two American firms (RCA and GTE Sylvania), one Dutch company (Philips), and one Japanese manufacturer (Hitachi) assemble color TV picture tubes, using imported electron guns, glass envelopes, and shadow masks. Their combined output, which totaled 106,000 units in 1973, should be sufficient to meet domestic demand by 1975. Makers of color TV picture tubes are expected to be producing nearly 200,000 units annually by 1977, using domestically manufactured parts exclusively.

Diodes and rectifiers are made in Mexico by four subsidiaries and licensees of American, Dutch, German, and Japanese component manufacturers. Three of these firms—affiliates of Fairchild, Philips, and Toshiba—also make transistors and import most of the wafers. Integrated circuits are manufactured by Fairchild, Toshiba, and Cia. General de Electronica, S.A.

Most major U.S. and third-country electronic component producers have established sales and/or manufacturing subsidiaries or exclusive representation to market their products in Mexico. Nevertheless, opportunities exist for other U.S. suppliers—particularly those offering highly specialized product lines—to establish themselves in this market. Mexican trade policy is protectionist but places most foreign suppliers, other than LAFTA members, on

an equal footing. U.S. component manufacturers benefit, however, from the high degree of U.S. participation in the ownership of Mexican electronic equipment firms.

The Government of Mexico has long sought to promote the substitution of domestic production for imports. This policy, implemented primarily by means of stringent controls on the granting of import permits, is applied not only to electronic components but to the full range of goods entering Mexico. The Government recently has placed greater emphasis on trade with other LAFTA members to take advantage of lowered trade barriers and to help improve the balance of payments between Mexico's relatively industrialized economy and the economies of its neighbors to the south. Reflecting the new emphasis, trade in electronic components between Mexico, Brazil, and Argentina is already increasing. Much of the rise reportedly can be traced to the activities of multinational corporations. Their affiliates are being urged to specialize in the production of certain components for the entire Latin American market rather than to attempt to manufacture the full product line in each of the three abovementioned countries.

Import duties.—Ad valorem duties on most product category components range from 4 to 20%, with duties of 30 to 50% on certain types of resistors. Information on official duty rates applicable to specific components within the product category may be obtained from the U.S. Department of Commerce, Domestic and International Business Administration, Room 4217, Main Commerce, Washington, D.C. 20230.

Technical Requirements

The electrical power supply characteristics in most areas of Mexico are 100 volts, 60 hertz. However, Mexico City still operates on 125 volt, 50 hertz current. Pending the completion of a conversion program, all imported equipment should be suited for both 50- and 60-hertz operation.

The metric system of weights and measures is the statutory standard in Mexico.

Published national standards for electronic components in Mexico may be obtained through the American National Standards Institute, Inc., 1430 Broadway, New York, N.Y. 10018.

The following market research study, upon which this Country Market Survey is based, is available on loan from the U.S. Department of Commerce, Domestic and International Business Administration, Room 1617M, Main Commerce, Washington, D.C. 20230:

"The Market for Electronic Components in Mexico," DIB 74-02-512, November 1973.

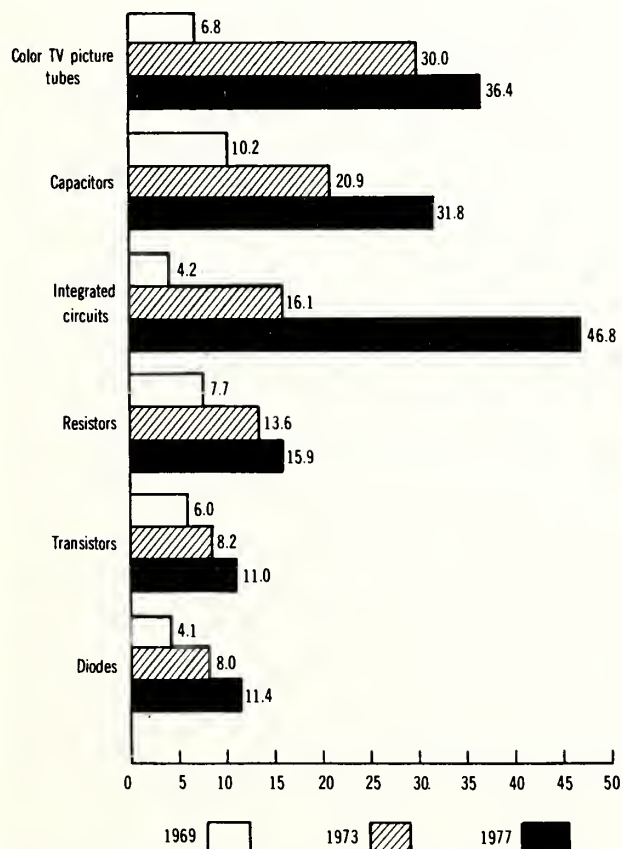
Sweden

Sweden's electronics industry is rapidly expanding production to take advantage of the mushrooming worldwide demand for electronic products. Industry output is expected to climb from \$912 million to \$1.5 billion during the 1972-77 period—an increase of 64%.

The Swedish market for electronic components covered in this survey is expected to grow at an even more rapid rate than industry output during the same period. Based on a predicted 19% average annual growth rate, the market is forecast to more than double from \$76.2 million in 1972 to nearly \$155 million in 1977. The market in 1973 amounted to \$96.8 million, an impressive \$20.6 million increase over 1972 (see table 1).

Sweden: Size of market for selected groups of electronic components, 1969-77

(in millions of U.S. dollars)



Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

Sweden imported more than 75% of product category components needed for its fast-growing electronics industry in 1973. Imports rose from \$40.5 million in 1971 to \$73.1 million in 1973 and should increase 10% a year into 1977, when they are expected to total almost \$110 million.

Swedish purchases of U.S.-made components within the product category amounted to \$10.3 million in 1972, accounting for 18% of the total import market (see table 2). The United States is already Sweden's leading supplier of many of the more advanced components. The country's growing requirements for advanced components, coupled with the need to establish additional sources for components in short supply, ensure good prospects for further market penetration by American exporters.

Other foreign suppliers of product category components to Sweden include Germany, the Netherlands, the United Kingdom, and France.

Product Category Definition

Electronic components covered in this survey are basically confined to resistors, capacitors, color TV picture tubes, diodes and rectifiers, transistors, and integrated circuits.

The term "product category" as used in this publication is limited to these six groups of components.

**Sweden—Selected Indicators
(1972)**

Gross national product:	\$41.9 billion
Population:	8.2 million
Total country imports:	\$8 billion
Imports from U.S. (w/share of total):	\$583 million (7%)
Total country exports:	\$8.7 billion
Exports to U.S. (w/share of total):	\$616 million (7%)
Exchange rate (May 1974):	4.28 kroner=US\$1

Sales Opportunities

The Swedish electronics industry is entering a period of rapid transition from the use of components in their maturing or declining life cycle stages to the widespread application of advanced devices which have been introduced in the last few years. A market research survey recently conducted in Sweden for the U.S. Department of Commerce, Office of International Marketing reveals that favorable sales opportunities exist for American exporters of the following electronic components.

Color TV picture tubes.—Sweden's market for color TV picture tubes more than doubled from \$14.7 million in 1971 to \$30 million in 1973. The rise has been in response to high domestic demand for color television sets. The market is expected to advance 20% during the 1973-77 period, exceeding \$36 million in the latter year.

There is no domestic production of color TV picture tubes in Sweden. Manufacturers of television sets therefore rely entirely upon imports to fulfill their requirements. The country's two major television manufacturers reportedly have been forced to limit their production because of the worldwide shortage of electronic parts and components. This puts U.S. exporters in a favorable position to increase their share of the picture tube market, which in 1972 was a modest 3%, or \$700,000.

Capacitors.—Annual Swedish purchases of capacitors increased more than 68% during the 1971-73 period, rising from \$12.4 million to \$20.9 million. Purchases are expected to approach \$32 million in 1977.

Imports of capacitors rose steadily from \$6.1 million in 1971 to \$9.1 million in 1973. Based on a predicted 14% average annual growth rate, imports are projected to exceed \$15 million in 1977. U.S. firms, which accounted for 21% (\$1.5 million) of the 1972 import market, should find the following devices highly salable:

- Tantalum electrolytic capacitors

- Aluminum electrolytic capacitors
- Metallized plastic capacitors

New applications for capacitors in a wide range of electronic end products and subassemblies should bolster sales despite the displacement of some types by integrated circuits. In particular, demand for metallized plastic film and electrolytic capacitors should remain strong for the next several years.

Integrated circuits.—The Swedish market for integrated circuits is expected to rise from \$16.1 million in 1973 to nearly \$47 million in 1977, reflecting an average annual growth rate of 30%. Purchases grew by about 60% during the 1971-73 period, up from a modest base of \$6.2 million in the former year.

Imports should virtually triple from \$9.3 million in 1973 to nearly \$27 million in 1977. Swedish purchases of American-made integrated circuits advanced 130% from \$1.3 million in 1971 to \$3 million in 1972, increasing the U.S. import market share from 38 to 42% in that period. The following types of IC's offer the best sales opportunities for American manufacturers:

- Linear integrated circuits
- Digital integrated circuits
 - bipolar, including MSI/LSI
 - MOS, including PROM
 - TTL
- Hybrid integrated circuits
 - thick film
 - thin film

Resistors.—The Swedish market for resistors increased an average of 22% a year between 1971 and 1973, rising from \$9.1 million to \$13.6 million. Annual purchases are projected to approach \$16 million in 1977.

Imports grew from \$7.2 million in 1971 to \$10.9 million in 1973 and should reach \$12.5 million in 1977. Purchases of resistors from the United States in 1972 amounted to \$1.3 million, or 14% of total imports.

Swedish equipment manufacturers are replacing carbon resistors with metal film and metal oxide resistors because of the superior tolerance, stability, and reliability of the metal resistors. Carbon resistors, in turn, are displacing composition resistors in some applications. Swedish users are showing a preference for cermet potentiometers, which should be an expansionary market for the next few years. American manufacturers supply virtually all of the precision potentiometers used in the country, and these devices should enjoy good future sales. Rising Swedish demand for potentiometers could develop into a lucrative market for U.S. exporters during the next 5 years.

Transistors.—The market for transistors increased from \$5.5 million in 1971 to \$8.2 million in 1973 and is expected to expand an average of almost 8%

a year through 1977, when it should reach \$11 million.

Imports of transistors, which amounted to \$5.3 million in 1971 and \$7.7 million in 1973, are forecast to exceed \$10 million in 1977. The United States accounted for 37%, or \$2.5 million, of the country's total imports of transistors in 1972.

U.S. manufacturers fill more than 50% of Swedish requirements for both field effect and microwave transistors. These devices are expected to be in growing demand during the next several years despite the steady displacement of transistors by integrated circuits in some product areas. The new applications being developed for these transistors, especially for power types, should ensure rising demand by Swedish users.

Diodes.—Swedish purchases of diodes should approach \$11.5 million in 1977, up from \$8 million in 1973. Purchases totaled \$4.3 million in 1971.

Imports, which accounted for 76%, or \$6.1 million, of the 1973 market, are expected to increase to nearly \$8 million in 1977. Sweden's imports of diodes from the United States in 1972 totaled \$1.3 million, or about 30% of total imports. U.S. exporters should find a good market for silicon diodes used in computers and for microwave diodes.

Power rectifier diodes account for over one-third of total Swedish purchases of diodes. While growth in the market for this type of diode will be modest, sales of triacs are expected to be brisk. U.S. manufacturers supply more than 50% of the Swedish demand for microwave diodes and more than 25% of that for silicon types. Both of these markets are expected to expand through 1977, and the U.S. position in the market should remain strong.

Other electronic components.—In addition to the six components groups surveyed, good sales opportunities will be found in Sweden for U.S. producers of the following electronic components:

Swedish purchases of connectors totaled \$1.3 million in 1972 and are expected to increase by 50% to almost \$2 million in 1977. The growth rate for rack-and-panel type connectors should exceed that predicted for the market as a whole and may average 20% annually for the 1972-77 period.

Swedish purchases of optoelectronic devices, which were valued at \$600,000 in 1971, are expected to accelerate markedly during 1974. It is anticipated that world production of these devices will reach a large enough scale in that year to effectively lower prices, making them more attractive to Swedish users. American manufacturers, the leading suppliers of optoelectronic devices to Sweden, can expect to profit from the projected rise in demand.

Selected End-User Industries

Swedish electronics firms are beginning to realize

Sweden—The Electronics Industry Basic Data (1972)

Total value of production:	\$912 million
Number of manufacturers:	211
Industry labor force:	100,000 (approximately)
Output of principal electronic component user industries (1971)—	
Consumer products industries:	
radios, television sets, and audio equipment	\$77.9 million
photographic equipment	\$2.7 million
Industrial/commercial equipment industries:	
computers and related equipment	\$72.8 million
communications equipment	\$371.3 million
measuring and testing instruments	\$21.9 million
medical electronic equipment	\$23.5 million

a technological level of production of electronic products that will sharply raise the industry's needs for advanced componentry. Manufacturers of industrial/commercial equipment are, and are expected to remain, the largest users of electronic components in Sweden. The consumer products sector is another promising market for components, although its needs are not nearly as great as those of the industrial/commercial equipment sector.

Although Sweden's military equipment sector has suffered from defense cutbacks in recent years, it should prove a steady customer for electronic components as the Viggen aircraft project and a new Swedish-Swiss missile program get fully underway.

The Swedish Government fosters growth in the electronics industry in two major ways. (1) It gives financial grants for academic research and development, with the goal of encouraging close cooperation between universities and businesses; (2) the Government also invests directly in industry through Statsforetag, a State holding company. All firms, including two electronics companies, that are part of Statsforetag operate on a profit basis. Statsforetag actively seeks joint ventures between Swedish and foreign firms to develop and produce innovative products.

Industrial/commercial equipment sector.—The Swedish industrial/commercial equipment sector in 1970 included approximately 250 firms with a total of 53,000 employees. Production in 1971 reached \$510 million, up 25% from \$408 million the

Table 1.—Sweden: Size of market¹ for selected groups of electronic components, 1969-77
(in millions of U.S. dollars)

Description	1969	1971	1972	1973	1974	1977
<i>Resistors</i>						
Production ²	1.2	2.3	3.0	3.4	3.9	4.1
Imports	6.7	7.2	8.8	10.9	11.3	12.5
Exports .....	.2	.4	.6	.7	.7	.7
Market size	7.7	9.1	11.2	13.6	14.5	15.9
<i>Capacitors</i>						
Production ²	7.1	9.6	14.5	19.5	22.5	34.1
Imports	5.8	6.1	7.3	9.1	10.5	15.4
Exports	2.7	3.3	4.2	7.7	10.5	17.7
Market size	10.2	12.4	17.6	20.9	22.5	31.8
<i>Color TV picture tubes</i>						
Production ²	—	—	—	—	—	—
Imports	6.8	14.7	23.3	30.0	34.1	36.4
Exports	—	—	—	—	—	—
Market size	6.8	14.7	23.3	30.0	34.1	36.4
<i>Diodes</i>						
Production ² .....	.1	1.3	1.7	2.3	2.7	4.1
Imports	4.0	3.1	4.4	6.1	6.6	7.7
Exports	—	.1	.2	.4	.4	.4
Market size	4.1	4.3	5.9	8.0	8.9	11.4
<i>Transistors</i>						
Production ²	—	.2	.2	.5	.4	.9
Imports	6.0	5.3	6.7	7.7	8.2	10.2
Exports	—	—	—	—	.1	.1
Market size	6.0	5.5	6.9	8.2	8.5	11.0
<i>Integrated circuits</i>						
Production ²	1.2	2.5	4.6	7.7	10.2	21.6
Imports	3.4	4.1	7.1	9.3	12.1	26.6
Exports .....	.4	.4	.4	.9	.9	1.4
Market size	4.2	6.2	11.3	16.1	21.4	46.8
<i>Totals</i>						
Production ²	9.6	15.9	24.0	33.4	39.7	64.8
Imports	32.7	40.5	57.6	73.1	82.8	108.8
Exports	3.3	4.2	5.4	9.7	12.6	20.3
Market size	39.0	52.2	76.2	96.8	109.9	153.3

¹ Size of market equals production plus imports minus exports. Parts and accessories not included.

² Production figures include components manufactured by OEM's for their own use only if delivered to another enterprise within the same organization.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

previous year. A 10% average annual growth rate in sector output is predicted for the 1972-77 period.

The telecommunications and computer industries are by far the most important within the sector and use the largest quantities of electronic components. Demand for components, however, is not limited to these two industries. The anticipated increase in the use of electronic systems by the automotive industry, for example, should provide a considerable boost to the sector's purchases of components. AB Volvo has recently recruited 60 engineers to staff a new department for the development of automotive electronics. The company could become a substantial buyer of electronic components, particularly if it begins producing its own electronic fuel-injection and other automotive electronic systems.

Telecommunications equipment.—The telecommunications equipment industry in Sweden in 1970 comprised 98 companies employing 33,500 people. It recorded sales of \$750 million in that year. Output of telephone equipment in 1971 reached \$298 million, representing over 50% of that year's total production of industrial/commercial equipment. Production of switchboards and exchanges amounted to over \$215 million in 1971; output of telephones totaled \$37 million and that of carrier-current equipment reached \$39 million.

Sweden's telecommunications systems are technologically highly developed. There are 5 million telephones in use in a completely automatic domestic network. A telecommunications satellite station will provide direct communication with most of South

America and Africa in 1974. Sweden built Europe's first stored-program exchange, which is located near Stockholm and has been in operation since 1968. The Swedish Telecommunications Board (STB) installed the world's first 60-mHz system over a 100-km coaxial cable between Orebro and Vasteras and recently extended it to Stockholm. Pulse code modulation (PCM) is planned now that there is a European standard of 32-channel, 8-bit speech code.

Two firms, Telefon AB L.M. Ericsson Company and Televerkets Industrier (Teli), produce about 95% of the telephone equipment in Sweden. Ericsson reported 1972 sales totalling \$406 million, mostly from telephone exchanges, switchboards, and telephones. The company's electronic component requirements are already substantial, and full-scale production of its new stored-program telephone exchanges will more than double its needs during the next few years. Ericsson produces its own relays and switches, and its subsidiary, AB Rifa, makes a wide range of components, including integrated circuits and other semiconductors. Although some of Ericsson's expanded component requirements will be met from either in-house manufacture or from its subsidiary, a large portion will come from other domestic and foreign sources.

Teli is a manufacturing subsidiary of the Swedish Telecommunications Board (STB) and employs 3,500 people. The STB, a self-supporting Government agency with annual sales of nearly \$1 billion and yearly capital investments of over \$200 million, originally formed Teli to compete with Ericsson. However, the two firms now cooperate closely to avoid duplication of product lines. In 1972, Teli made 500,000 telephones and 50,000 switchboards, as well as other telephone equipment, with a total value of \$65 million. The company plans to produce data transmission equipment for the domestic market by the end of this decade. Some 94% of Teli's output is for use by the STB. Telefabrikation AB

(Tefab), STB's other manufacturing subsidiary, produces exchanges, transformers, and telex sets. The firm's output totaled \$5.8 million in 1972.

Teli's 1972 semiconductor purchases amounted to \$375,000 and included selenium and zener diodes, rectifiers, silicon transistors, and some small thyristors. Company officials estimate that in the near future about 60% of Teli's total electronic component purchases will comprise digital integrated circuits. These will be necessary for the new stored program exchanges that are scheduled for installation in 1977. Teli is expected to buy approximately 30,000 integrated circuits annually beginning in 1975; most will be SSI, but some MSI will also be needed. Teli's purchases of passive components in 1972 included \$620,000 worth of capacitors and \$300,000 worth of resistors. Teli makes about 10 million telephone relays a year.

Standard Radio & Telefon AB (SRT), based in Vallingby, is the only U.S. subsidiary manufacturing telecommunications equipment in Sweden. SRT, although owned by ITT, operates independently. It has diversified its product line, branching out from the production of military equipment to include the manufacture of modems, multiplexers, and other devices for the civilian market.

The other major telecommunications firms in Sweden are Philips Teleindustri AB, in Stockholm, producing radio and TV transmitters and alarm systems; Aga Mobilradio AB, in Gavle, manufacturing mobile radios; and Stansaab Elektronik AB, in Jarfalla, making radar and air traffic control apparatus.

The Swedish Telecommunications Board plans to replace electromechanical exchanges with Ericsson's computer-controlled stored-program exchanges. Modernization and expansion of data transmission facilities in Sweden is expected to occur over the next several years. The number of public data terminals should reach 19,400 in 1980, up from only 3,600 in 1972. STB's plans for the near future also include the installation of 60-mHz cable transmis-

Table 2.—Sweden: Imports from the United States, and U.S. share of total imports, of selected groups of electronic components, 1969-72¹
(in millions of U.S. dollars)

Description	1969		1971		1972	
	Value	U.S. share (percent)	Value	U.S. share (percent)	Value	U.S. share (percent)
Resistors	1.8	27	1.1	15	1.3	14
Capacitors	1.4	24	1.1	18	1.5	21
Color TV picture tubes	—	—	—	—	.7	3
Diodes	1.4	35	1.2	39	1.3	30
Transistors	3.1	52	1.7	32	2.5	37
Integrated circuits	1.3	38	1.3	32	3.0	42
Total	9.0	28	6.4	16	10.3	18

¹ Parts and accessories not included.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

sion, which will quadruple the firm's present capacity.

Computers and related equipment.—Swedish production of computers and related equipment amounted to nearly \$200 million in 1972. Five firms together accounted for 60%, or \$120 million, of the total output of electronic data processing (EDP) and data transmission equipment in 1972. These were: Facit-Addo, in Atvidaberg; Datasaab in Linköping; and L.M. Ericsson, Stansaab Elektronik AB, and Asea LME Automation, all located in Vasteras.

Each of these firms specializes in the production of different types of EDP and related equipment. Facit-Addo, which is associated with AB Electrolux, produces a variety of computer peripherals, including paper tape punches, bank terminals, OCR terminals, magnetic tape recorders, and input devices. The company has 8,100 employees.

L.M. Ericsson manufactures data communications systems, including modems, concentrators, and terminals. The firm is the only Swedish supplier of specialized computers for stored-program telephone exchanges.

Datasaab, part of the Saab-Scania group, has 2,230 employees. The firm concentrates on the assembly of medium-size, general purpose computers, bank terminals, and numerical controls, as well as the development of software. It also makes its own thick film hybrid integrated circuits.

Stansaab, with 800 employees, specializes in the production of computers for air traffic control systems and hospital information systems. About 30% of the company's output consists of display terminals, and the firm presently holds roughly 60% of the Swedish market for these products.

Asea LME Automation is engaged in the production of process control systems using U.S.-manufactured minicomputers. Asea collaborates with L.M. Ericsson and two U.S. companies in the development and manufacture of on-line real-time process and production control systems.

IBM Svenska and Standard Radio & Telefon AB (SRT) are the only two U.S. manufacturing subsidiaries in the computer field in Sweden. IBM started full production in its new \$100-million factory near Stockholm in 1972 and mainly fabricates nonelectronic printers. SRT has 1,350 employees; it manufactures modems and multiplexers for data transmission.

Consumer products sector.—The value of Swedish production of consumer electronic products more than doubled during the 1968-71 period, climbing from \$35 million to \$72 million. The sector is currently enjoying a highly expansive period, caused in part by a boom in color television receiver sales.

A 10% average annual growth rate is envisioned for consumer products output in the 1973-77 period.

Television receivers and radios.—Output of color television receivers in 1971 reached \$54 million, reflecting a 50% annual increase from the 1968 level of \$16 million. Production of color TV sets accounts for about 75% of Sweden's total annual dollar volume of entertainment electronic products. Production of black-and-white TV sets declined during the 1968-71 period, dropping from \$13 million to \$6 million, in response to consumers' preference for color TV's.

Norrkopings Elektrotekniska Fabriker AB (Nefa) and Luxor Industri AB are the two major television producers in the country and employ a total of 4,000 workers. Nefa, long the dominant manufacturer of televisions and radios in Sweden, is a subsidiary of the Dutch company, Philips, and one of the parent firm's three largest facilities for developing and producing color TV's. Nefa has 60 engineers among its 2,000 employees. Between 1967 and 1973, it made 700,000 color TV receivers, of which 200,000 were exported. The company's current annual sales total about \$65 million and component purchases are on the order of \$38 million a year.

Luxor has become increasingly important in the domestic market. Its annual sales and labor force are almost as large as those of Nefa. It recently completed a \$4-million factory expansion program. Color televisions account for about 75% of the firm's total annual sales; monochrome TV sets, 8%; and stereophonic record players, 15%. Luxor purchases all of its parts from outside sources. It has had difficulty acquiring enough components to meet its requirements and is eager to find additional sources of supply.

Swedish production of radios rose from \$5.4 million in 1968 to \$11.5 million in 1971. Nefa and Luxor are the country's two major radio manufacturers.

Audio equipment.—Swedish annual production of audio equipment has remained stable over the past several years at about \$400,000. This trend is expected to continue. AB Sonab and Sinus AB are Sweden's two major companies producing audio equipment, mainly audio loudspeakers. Sonab is a Government-owned, profit-making company. Sinus, with 200 employees, manufactures automobile exhaust systems and silencers, in addition to loudspeakers.

The Competitive Environment

Swedish production of electronic components within the product category in 1973 amounted to \$33.4 million—more than double the 1971 level of \$15.9 million—and is projected to approach \$65

million in 1977. Domestic manufacturers of components, each with output exceeding \$1 million, are: L.M. Ericsson, including its subsidiaries AB Rifa and Svenska Radio AB; Asea and its subsidiary Hafo; Datasaab; and Gylling Elektronik Produkter AB.

Rifa's 1973 total output of electronic components amounted to \$22 million. Capacitors accounted for about 70% of this total. Integrated circuits are expected to account for 50% of the company's annual output by 1980. Asea's \$5-million component output in 1973 included thyristors, diodes, rectifiers, rotary switches, and GP relays. Its subsidiary, Hafo, manufactures MOS, custom-made semiconductors, thick film integrated circuits, and other components. Farad Electronics (Hagersten), a small company that primarily produces capacitors, is also associated with Asea.

Datasaab specializes in the assembly of thick film hybrid integrated circuits used in computers. Its 1977 output is projected to reach \$6 million, more than double the 1973 level. Gylling's production of printed circuit boards amounted to \$1.5 million in 1973 and is expected to reach \$3 million in 1977.

Production of electronic components in Sweden by U.S. or other foreign firms is limited. The ITT subsidiary, Standard Radio & Telefon AB, manufactures relays for its transmission equipment and some switches for radar apparatus. The Dutch company, Philips, has a subsidiary in Sweden that makes magnetrons for military use. Rifa, part of the Ericsson group, manufactures integrated circuits under license from U.S. firms. Rifa's production of electronic components is geared mainly to in-house requirements of the Ericsson group.

Government fosters electronics industry.—The Swedish Government encourages the development of the country's electronics industry through aid for education and research and through military contracts. The Government's goal is to develop a high level of technology in certain industry products, such as semiconductor devices and microwave and optical electronics, so as to enable Swedish companies to compete more effectively in international markets.

The Ministry of Industry's Board for Technical Development (Stu) allocated \$26 million in 1971 to universities, companies, and private organizations for research and development of 11 product groups, including electronic components. Stu is also collaborating with the Swedish Telecommunications Board on the modernization and expansion of the country's data communications network. One example of a Stu grant is the \$1.7 million allotted to Stansaab for the development of a hospital patient data system during 1974-76. Saab-Scania, Svenska Radio, and Philips Teleindustri AB are among the other

large electronics firms that have received R&D funding from Stu.

Swedish electronic components manufacturers are actively promoting exports. For example, the objective of Rifa's global marketing program is to export more than 50% of its projected \$35-million output of capacitors in 1977. Sweden's total exports of the six selected groups of electronic components surveyed more than doubled during the 1971-73 period, climbing from \$4.2 million to \$9.7 million. Exports are projected to exceed \$20 million in 1977.

Swedish users attach a great importance to maintaining several sources of supply for components, especially in light of the current worldwide component shortage. U.S. manufacturers of electronic components, recognized by Swedish users as world leaders in technology and design, are in an excellent position to achieve successful penetration of this growth market. Swedish buyers generally prefer U.S.-made products rather than those of U.S. subsidiaries manufacturing in Europe, although delivery times can make this preference impractical.

A number of U.S. companies are successfully marketing electronic components in Sweden. Texas Instruments, for example, maintains a sales subsidiary in Stockholm to negotiate contracts, a supply company in Gothenburg, and sales representatives/distributors in Stockholm. ITT, Motorola, Semiconductor Products, Inc., Litton Precision Products, Varian Associates, and Westinghouse are among the other American companies with sales subsidiaries in Sweden. Beckman-Helipot, Fairchild, Harris Semiconductor, National Semiconductor, and Intersil have established sales representation in Sweden.

Major competitors of U.S. firms in the Swedish market for electronic components include Siemens of Germany, which is a factor in GP relays and switches, and Beyschlag in carbon resistors. Roederstein, another German firm, is a major source of capacitors for Swedish users. Philips is the most significant Dutch supplier of components to Sweden and offers devices ranging from metal film capacitors to integrated circuits. Three British firms successfully selling components in Sweden are Plessey (toggle switches), Sealecho (miniature connectors), and Transradio (coaxial connectors). The Danish firm, Citrohm, has made successful inroads in the market for composition and wirewound resistors.

The Swiss firm Elmia has found a market in Sweden for its rotary switches, as has another firm from Switzerland, Suhner, for its coaxial connectors. The French companies, Socapax and Souriau, are active in marketing connectors. Japan, which accounted for only about 1% of Sweden's electronic components imports in 1972, is represented by Nippon Electric, a supplier of indicator tubes.

Import duties.—Sweden's customs duty on most

electronic components is 5%, based on the cost, insurance, and freight (c.i.f.) value. The duty is 8.5% on capacitors, 8% on resistors, and 7% on circuit-breaking apparatus and printed circuits. Television tubes for both receivers and cameras may be imported duty-free. An appeal is expected to be made for duty exemption for other components not manufactured in Sweden.

Imports from current and former European Free Trade Association (EFTA) members enter Sweden duty-free. In 1973, Sweden and the other EFTA members entered into a preferential trade agreement with the European Economic Community (EEC) which provides for the elimination of tariffs on industrial goods traded among these countries by 1977. Under the terms of this trade relationship, duties on industrial products (including electronic components) imported from the nine EEC member countries will be progressively reduced by 20% annually until they are completely abolished by July 1, 1977.

Information on official duty rates applicable to specific types of components within the product category may be obtained from the U.S. Department of Commerce, Domestic and International

Business Administration, Room 4217, Main Commerce, Washington, D.C. 20230.

Technical Requirements

The electrical power supply characteristics in Sweden are 220/380 volts, single- and 3-phase, 50 hertz, four-wire.

The metric system of weights and measures is the statutory standard in Sweden.

Published national standards for electronic components in Sweden may be obtained through the American National Standards Institute, Inc., 1430 Broadway, New York, N.Y. 10018.

The following market research study, upon which this Country Market Survey is based, is available on loan from the U.S. Department of Commerce, Domestic and International Business Administration, Room 1617M, Main Commerce, Washington, D.C. 20230:

"The Market for Electronic Components in Sweden," DIB 74-05-506, November 1973.

Switzerland

Switzerland's sizable output of electronic products, estimated at \$1.2 billion in 1972, makes this country an attractive marketplace for U.S. manufacturers of electronic components.

The total Swiss market for electronic components is expected to increase 38% between 1973 and 1977, climbing from \$85 million to \$117 million. The rapid rate of expansion anticipated through 1977 in annual output of electronic products, particularly by the watch and clock segment of the electronics industry, will provide the major impetus for this strong market growth.

Switzerland's market for the selected groups of electronic components covered in this survey rose from \$29.4 million in 1971 to \$52.7 million in 1973, an increase of close to 80% (see table 1). The market is forecast to rise at an average annual rate of nearly 8%, reaching over \$70 million in 1977.

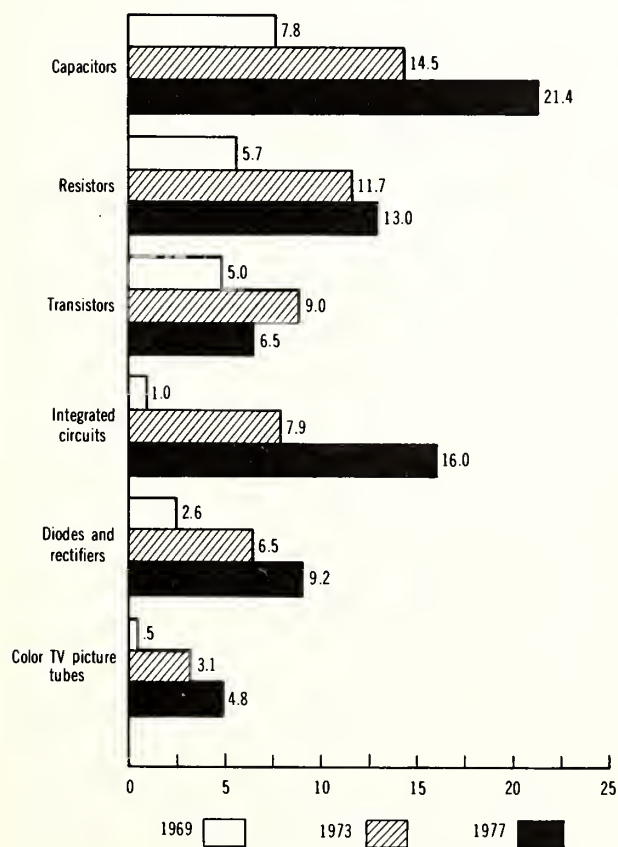
Imports averaged 62% of the total market for product category components during the 1971-73 period. The annual value of imports grew an average of 14.5% a year during that period, rising from \$18.6 million to \$32 million. Imports are expected to continue to account for over 60% of the market during the next 4 years and should approach a \$44-million annual level in 1977.

The United States has increased its share of Switzerland's import market for product category components during the past few years. U.S. exporters accounted for 42% (\$9.2 million) of Swiss imports in 1972, compared with 39% (\$5.5 million) in 1969 (see table 2). If American suppliers retain their current share of the import market, they can look forward to sales in excess of \$18 million in 1977.

The United States has increased its share of Switzerland's import market for product category components during the past few years. U.S. exporters accounted for 42% (\$9.2 million) of Swiss imports in 1972, compared with 39% (\$5.5 million) in 1969 (see table 2). If American suppliers retain their current share of the import market, they can look forward to sales in excess of \$18 million in 1977.

Switzerland: Size of market for selected groups of electronic components, 1969-77

(in millions of U.S. dollars)



Source: U. S. Department of Commerce, Bureau of International Commerce market survey.

Product Category Definition

Electronic components covered in this survey are basically confined to resistors, capacitors, color TV picture tubes, diodes and rectifiers, transistors, and integrated circuits.

The term "product category" as used in this publication is limited to these six groups of components.

**Switzerland—Selected Indicators
1972**

Gross national product:	\$30.2 billion
Population:	6.31 million
Total country imports:	\$8,462 million
Imports from U.S.	
(w/share of total):	\$586 million (7%)
Total country exports:	\$6,830 million
Exports to U.S.	
(w/share of total):	\$594 million (9%)
Exchange rate (May 1974):	2.93 S. francs=
	US\$1

Major competitors of the United States in the Swiss market for electronic components are Germany, France, and Italy.

Sales Opportunities

A market research survey recently conducted in Switzerland for the U.S. Department of Commerce, Office of International Marketing reveals that favorable sales opportunities exist for American exporters of the following electronic components.

Transistors.—The market for transistors in 1973 totaled \$9 million, up \$2.1 million over 1971. It is forecast to drop to less than \$7 million in 1977, when competitively priced IC's are expected to signal the end of the growth stage of the transistor life cycle.

The projected decline in the market for transistors is expected to result in a proportional decline in imports. Demand for imported transistors is forecast to drop from \$6.8 million in 1973 to \$4.8 million in 1977. American manufacturers held the predominant share of Switzerland's import market for transistors in 1972, accounting for 74%, or \$4.6 million, of the total.

Swiss buyers are expected to show particular interest in low-cost silicon power transistors and silicon RF power transistors.

Integrated circuits.—Sales of integrated circuits experienced the highest growth rate of any single group of components under review. Annual sales increased nearly fourfold from \$2 million in 1971 to \$7.9 million in 1973. Sales are expected to rise at a 20% average annual rate during the 1973-77 period, reaching \$16 million in the later year.

Imports in 1973 totaled \$5.6 million, up more than 270% over the 1971 level of \$1.5 million. Import demand in 1977 is now expected to exceed \$11 million, or double the 1973 total. The United States is the dominant foreign supplier of IC's to Switzerland, commanding about two-thirds of the import market. Imports from the United States in 1972 amounted to \$2 million.

Sales of IC's are expected to accelerate during the 1970's as manufacturers in Switzerland's two major industries—watch manufacturing and telecommunications—step up output of products with advanced electronic systems. Other user subsectors expected to contribute to the expansion of the Swiss market for IC's are the machine tool and military equipment industries.

Demand in the watch and clock industry is strongest for CMOS circuits. The industry is now evaluating the use of injector logic and bipolar and MOS circuits in electronic timing devices. Its decision is expected to be made soon.

The use of IC's in communications and telecommunications equipment is increasing as a result of the introduction of electronic exchange systems and of pulse code modulation (PCM) transmission equipment. Swiss producers of industrial control and instrumentation equipment have used few IC's up to the present time. However, they now are including MOS circuits in the designs of their new products.

There are increasing opportunities for sales of IC's to the sewing machine industry and to the manufacturers of tape and video recorders and record players. The latter industry is a growing market for custom-made IC's, particularly bipolar and LSI circuits.

Diodes and rectifiers.—Switzerland's market for diodes and rectifiers rose from \$3.3 million in 1971 to \$6.5 million in 1973. Based on a predicted 8.5% average annual growth rate, the market is projected to exceed \$9 million in 1977.

Purchases of foreign-made diodes and rectifiers account for more than 50% of the market. Total imports, valued at \$1.8 million in 1971, rose to \$3.5 million in 1973. Imports are expected to reach \$5 million in 1977, an increase of 43% over the 1973 level. The United States is Switzerland's principal foreign supplier of diodes and rectifiers. Imports from the United States in 1972 amounted to \$1.6 million, or 73% of the total.

The highest sales potential for U.S. exporters in this segment of the market lies in high-power devices. While the demand for rectifiers is expected to rise in the years just ahead, the longer-term outlook for sales of diodes is not encouraging because they are being increasingly displaced by IC's.

Capacitors.—Switzerland's market for capacitors rose to \$14.5 million in 1973, an increase of 62% over the 1971 figure of \$9.2 million. The market is expected to more than double during the 1973-77 period, reaching over \$21 million in the latter year.

About two-thirds of Switzerland's requirements for capacitors are met by imports. Total imports are expected to grow an average of 10% a year, rising from \$9.6 million in 1973 to \$14 million in 1977.

The United States supplied about 12% (\$800,000) of the country's annual imports in 1971 and 1972.

Switzerland's industrial/commercial electronic equipment sector is expected to continue to be a major market for high-quality electrolytic capacitors. Rapidly expanding production of digital clocks and watches is expected to generate a sharp rise in demand for microvariable capacitors for tuning quartz oscillators at least through 1975.

Resistors.—Swiss purchases of resistors advanced 46% from \$7.1 million in 1971 to \$11.7 million in 1973. Purchases are expected to reach \$13 million in 1977.

Imports accounted for 22%, or \$3.4 million, of the 1973 market. This represented a 36% increase over the 1971 level of \$2.5 million. The value of imports in 1977 is projected at \$4 million. The annual U.S. share of imports averaged a modest 8% (\$180,000) during the 1969-72 period. The best U.S. export sales potential lies in variable resistors.

Other electronic components.—Among the types of electronic components outside the product category that offer promising sales opportunities to U.S. exporters are connectors, relays and switches, and thyristors.

Sales of connectors are expected to increase from \$3.2 million in 1972 to \$4.5 million in 1977. This growth will stem primarily from expanded use of modular design circuits in industrial/commercial equipment. The bulk of demand is for printed circuit and rack and panel connectors.

The 1972 market for relays and switches was \$2.7 million. Growing Swiss requirements are predicted for switches in the lower power miniaturized range, but sales of other types of components in this group are expected to drop with the increased application of solid state devices.

Thyristor sales in 1972 totaled \$800,000. Good import prospects are seen for a wide range of thyristors, especially for those types used in industrial/commercial equipment requiring high-power and high-voltage unidirectional devices. Fast thyristors to switch power supplies also offer good sales prospects for U.S. manufacturers.

Selected End-User Industries

Production in Switzerland's industrial/commercial electronic equipment sector totaled \$300 million in 1972. The sector's output encompasses telecommunications equipment, measuring and control instruments, calculators, and computers and related equipment. Manufacturers expect to increase output to nearly \$500 million in 1977 to meet expanding domestic and foreign demand for their products.

Swiss production of consumer electronic products, excluding watches and clocks, amounted to almost

Switzerland—The Electronics Industry Basic Data (1972)

Total value of production (est.)	\$475 million
Industry labor force (est.)	120,000
Output of principal electronic components user industries—	
Consumer products industries:	
radios and audio equipment	\$37 million
photographic equipment	\$35 million
television sets	\$15 million
Industrial/commercial equipment industries:	
telecommunications equipment	\$159 million
measuring, test, and control instruments	\$97 million
computers and related equipment	\$16 million
electronic desk calculators	\$9.5 million
medical electronic equipment	\$9.2 million

\$124 million in 1972 and is expected to reach \$160 million in 1977. Production of watches and clocks is forecast to exceed \$1 billion in 1977, up from \$708 million in 1972.

The watch and clock industry is treated separately in this survey because of its unique position in relation to the other subsectors of Switzerland's electronics industry. The aggregate annual production value of all other industry subsectors is only about two-thirds as high as that of watch and clock production. A rapid rate of expansion from its current small base is anticipated in consumption of electronic components in the watch and clock subsector. Annual consumption, estimated at \$2 million in 1972, is expected to skyrocket to \$50 million in 1976 and expand even more rapidly in the years thereafter.

Approximately 70% of total Swiss electronic component purchases currently are made by industrial/commercial equipment manufacturers. The consumer products sector should increase its share of components purchases from 23% to 38% by 1977. Military equipment manufacturers are expected to continue to account for about 7% of the components market. Aggregate purchases of electronic components by U.S. subsidiaries and licensees in Switzerland account for approximately 15% of the market.

Watch and clock industry.—Switzerland's watch and clock industry supplies 45% of the world's watches and 4% of its clocks. Although it faces increasing competition from Russia and Japan, the Swiss industry is expected to maintain its current

Table 1.—Switzerland: Size of market¹ for selected groups of electronic components, 1969-77
(in millions of U.S. dollars)

Description	1969	1971	1972	1973	1974	1977
<i>Resistors</i>						
Production ²	7.4	9.2	10.6	15.8	16.5	17.1
Imports	1.8	2.5	2.5	3.4	4.0	4.0
Exports	3.5	4.6	5.1	7.5	8.1	8.1
Market size	5.7	7.1	8.0	11.7	12.4	13.0
<i>Capacitors</i>						
Production ²	4.4	5.4	6.2	9.0	10.0	14.0
Imports	5.6	6.7	6.4	9.6	10.5	14.0
Exports	2.2	2.9	3.0	4.1	4.5	6.6
Market size	7.8	9.2	9.6	14.5	16.0	21.4
<i>Color TV picture tubes</i>						
Production	—	—	—	—	—	—
Imports .....	.5	.9	1.8	3.1	3.8	4.8
Exports	—	—	—	—	—	—
Market size .....	.5	.9	1.8	3.1	3.8	4.8
<i>Diodes and rectifiers</i>						
Production ²	2.3	3.1	3.7	6.0	7.0	8.1
Imports	1.5	1.8	2.2	3.5	4.2	5.0
Exports	1.2	1.6	1.9	3.0	3.4	4.1
Market size	2.6	3.3	4.0	6.5	7.8	9.2
<i>Transistors</i>						
Production ²	2.6	3.3	3.6	4.5	4.0	3.4
Imports	3.7	5.2	6.2	6.8	6.1	4.8
Exports	1.3	1.6	1.8	2.3	2.0	1.7
Market size	5.0	6.9	8.0	9.0	8.1	6.5
<i>Integrated circuits</i>						
Production ²	—	1.0	2.0	4.5	6.5	10.0
Imports	1.0	1.5	2.7	5.6	7.8	11.2
Exports	—	.5	1.0	2.2	3.3	5.2
Market size	1.0	2.0	3.7	7.9	11.0	16.0
<i>Totals</i>						
Production ²	16.7	22.0	26.1	39.8	44.0	52.6
Imports	14.1	18.6	21.8	32.0	36.4	43.8
Exports	8.2	11.2	12.8	19.1	21.3	25.7
Market size	22.6	29.4	35.1	52.7	59.1	70.7

¹ Size of market equals production plus imports minus exports. Parts and accessories not included.

² Production figures do not include components manufactured by OEM's for their own use.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

share of the market in the years just ahead. It produced about 80 million units in 1972, and these were valued at \$708 million. Approximately 97% of production was exported. Production in 1977 is expected to increase to 90 million units, worth close to \$1.1 billion.

The industry is expected to become a major producer of electronic watches and clocks by 1975. Current production includes:

- Clocks and watches with conventional face and mechanical balance or tuning fork, using simple electronic voltage stabilization and drive components (about 2 million units annually)
- Clocks and watches with either a conventional face or mechanical digital readout, oscillating quartz, and a divider IC (about 50,000 units, principally watches)
- Clocks and watches with digital readout (liquid crystal or light-emitting diodes), quartz, divider, and decoding and drive IC's (production is still very small)

Output of electronic timepieces will grow rapidly once the industry solves certain technical problems. For instance, it must develop a method to mass-produce the low-frequency quartz and increase its resistance to shock. The industry currently uses an oscillating quartz with 32,768 hertz. This is expected to change when dividers made for higher frequencies and low-power consumption become available.

Swiss watchmakers are highly dependent on the United States for the advanced technology required for production of solid state quartz watches. They have imported the necessary IC's and watch kits from Texas Instruments, Motorola, RCA, Microma Universal, Intersil, Solid State Scientific Devices, and Optel. Switzerland's Huer-Leonidas, in Biel, uses Sperry Rand displays for solid state digital timers. Swiss watch manufacturers and research organiza-

tions keep in close contact with the U.S. companies in a continuing effort to improve the technological development of their production.

The watch and clock industry comprises primarily many small factories. A 1971 study counted 1,163 factories employing 69,431 workers. Over 1,000 of these had fewer than 100 employees and only 4 factories employed in excess of 1,000 persons.

The industry is organized into numerous associations, federations, and societies. The most influential association is the *Chambre Suisse de l'Horlogerie* (CSH), which represents the entire watch and clock industry in governmental and foreign trade matters and acts as a coordinating body for the other major federations and associations. The *Societe Suisse pour l'Industrie Horlogere* (SSIH) is the largest producers' organization.

The *Centre Electronique Horloger* (CEH) serves as an independent research organization for the development of electronic movements. Manufacturers subscribe to CEH and use the products it develops as the basis for their own production. However, this does not preclude the larger firms from pursuing their own R&D programs.

Ebauches S.A., in Marin, is a central holding company whose subsidiaries make piece-parts and watch movements. It has a research division that is developing electronic watches and owns a firm, *Oscilloquartz S.A.*, in Neuchatel, that manufactures quartz crystals for a wide variety of timing devices, including electronic watches.

The firm of *Bernard Golay S.A.*, in Lausanne, is a major producer of quartz clocks and watches. It has developed production of electronic watches and sold its know-how to both Ebauches S.A. and *Longines S.A.*, in St. Imier. *Bernard Golay* has a joint venture in India for the production of electronic watches and also contemplates setting up production facilities in the United States.

Two Swiss companies, *Le Portescap S.A.* and *Arthur Imhof*, have jointly developed the smallest

quartz clock movement now on the market. It consists of a battery, quartz, electronic frequency divider, control circuit, transducer, step motor, and clockwork.

Other major Swiss manufacturers of quartz clocks and watches include: *Omega* (*Louis Brandt & Frere S.A.*), in Biel; *Jaeger le Coultre & Cie*, Geneva; *Societe de Garde-Temps*, *Girard Perregaux*, and *Longines*.

The *Bulova Watch Co., Inc.*, which opened its *Ateliers Division* in Biel after World War I, is the only important U.S. subsidiary manufacturing watches and clocks in Switzerland. *Bulova* is one of Switzerland's leading producers of tuning fork watches. The company has a factory in *Neuchatel* that mainly produces *Accutron* watches. *Bulova* has a production capacity in Switzerland of approximately 2 million watches and clocks a year.

The *Societe Suisse pour l'Industrie Horlogere* (SSIH) has bought a majority holding in two well-known American companies, *Hamilton Watch Corporation* and *Sheffield Watch Corporation*. It also has undertaken a joint venture with the U.S. firm *Intersil* to produce *COS/MOS* circuits and liquid crystal displays in Germany.

Industrial/commercial equipment sector.—Despite constraints on production created primarily by labor shortages, Swiss manufacturers of industrial/commercial electronic equipment expect to expand their output at an average annual rate of almost 5% through 1977. Modern automated production methods are being increasingly emphasized by these manufacturers in their efforts to alleviate the labor shortage problem and improve productivity. The sector employs an estimated 35,000 workers.

Telecommunications equipment.—Swiss telecommunications equipment production in 1972 totaled \$129 million, about 43% of total sector output. Exports were \$37 million. The bulk of telecommunications equipment is sold to the Swiss Posts, Tele-

Table 2.—Switzerland: Imports from the United States, and U.S. share of total imports, of selected groups of electronic components, 1969-72¹

(in millions of U.S. dollars)

Description	1969		1971		1972	
	Value	U.S. share (percent)	Value	U.S. share (percent)	Value	U.S. share (percent)
Resistors	140	8	200	8	200	8
Capacitors	700	12	800	12	800	12
Color TV picture tubes	—	—	—	—	3	*
Diodes and rectifiers	1,100	73	1,300	72	1,600	73
Transistors	2,800	76	3,900	75	4,600	74
Integrated circuits	740	74	1,100	73	2,000	75
Total	5,480	39	7,300	39	9,203	42

¹ Parts and accessories not included.

* Less than 0.5%.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

phone, and Telegraph (PTT) authority, and therefore is made to its specifications.

Hasler AG, of Berne, with about 50% of the market, dominates the industry. Standard Telephon und Radio AG (STR) and Siemens-Albis AG, both located in Zurich, are the other major telecommunications equipment producers. Hasler products include private and public telephone exchanges, carrier frequency and PCM transmission systems, and telex transmission and switching systems. Hasler also makes components, primarily for its own use. These include HF-coils, wirewound resistors, connectors, DTL integrated circuits, Ge-transistors, and mechanical relays.

Hasler has developed a number of technologically advanced electronic products, such as computerized telex exchanges and solid state telephone exchanges. Under a project managed by the PTT, it has been associated with Siemens-Albis and STR in developing a PCM transmission system that is expected to be less expensive than the traditional carrier frequency system.

STR's current production of telecommunications equipment is limited to telephone exchanges for the PTT. It supplies an estimated 75% of the PTT's requirements. STR exports less than 10% of its total annual production. It is a subsidiary of ITT and the only U.S. subsidiary producing telecommunications equipment in Switzerland. It buys about 40% of its components through ITT and produces small quantities of relays and capacitors for its own needs.

Measuring, test and control equipment.—The measuring, test, and control instrument industry is the second most important industrial/commercial equipment subsector in terms of size and growth potential. Its production growth rate is expected to exceed 9% annually between 1972 and 1977. Production was valued at \$97 million in 1972 and is projected to reach \$166 million in 1977. Control instruments make up the largest part of the industry's production. Rapid growth in the domestic market for this equipment is anticipated, since a large share of production is purchased by two of Switzerland's more dynamic industries—precision instruments and chemicals. Exports of control instruments also are expected to expand rapidly in the years just ahead.

Communications equipment.—Swiss communications (radio communications, radar and navigation aids, and public broadcasting) equipment output is expected to grow from \$30 million in 1972 to over \$40 million in 1977 and expand even more rapidly in the years thereafter. The communications equipment industry also has excellent prospects for export growth. The industry's major manufacturers are AG Brown, Boveri & Cie of Baden and Auto-phon AG of Solothurn.

Computers and related equipment.—Swiss manufacturers produce some computers, electronic desk calculators, and related equipment. Total production was worth \$26 million in 1972 and should reach approximately \$50 million in 1977. Production of electronic calculators is expected to rise from 42,000 units in 1972 to about 70,000 units in 1977.

Most of Switzerland's computers are imported. During the period 1973-77, Switzerland is expected to import over \$835 million worth of computers and related equipment, with U.S. exporters supplying more than \$250 million of this market. There is one important Swiss manufacturer of mainframes, Paillard, in Yverdon. Paillard recently began production of a digital computer called the "Hermes Data System 210," which is similar to the NCR 399.

NCR has a subsidiary in Bulach, near Zurich, which manufactures computer peripherals for both the Swiss market and worldwide distribution. Zellweger, of Uster, a maker of communications and control equipment, has developed a point-of-sale system that could lead to increased output of computers when it is put into production around 1975.

Medical electronic equipment.—Switzerland's production of medical electronic equipment amounted to \$9.2 million in 1972 and should reach \$19 million in 1977.

Consumer products sector.—The principal users of electronic components in Switzerland's consumer products sector are the manufacturers of audio equipment, domestic appliances, and photographic equipment. The sector employs approximately 5,000 workers.

Both labor shortages and an influx of consumer products from countries with low cost labor have slowed production growth in this sector. The sophisticated radio and audio equipment industry is an exception, however; its average annual rate of growth is expected to continue to be 9% through 1977.

Radios and audio equipment.—Production of radios and other audio equipment was about \$37 million in 1972 and could exceed \$62 million in 1977. Practically all radios are imported, but the firm of Willi Studer, in Regensdorf, makes some high-quality stereo and high-fidelity radio receivers, as well as tape recorders and high-fidelity amplifiers, under the brand name "Revox." The company exports a considerable amount of its production to the United States.

Lenco AG Plattenspielerfabrik, of Oberburg, makes record players that have sold well throughout Europe. Kudelski S.A., in Cheseaux, produces professional tape recorders. Its annual sales are about \$4 million. Kudelski's president, Stefan Kudelski, was awarded an Oscar by the American film industry and was given the Samuel L. Warner gold medal for his Nagra miniaturized professional tape recorders.

Domestic appliances.—Swiss production of domestic appliances includes mixers, vacuum cleaners, washing machines, electric cooking appliances, dimmers, and sewing machines. The value of production was \$37 million in 1972 but is expected to drop to about \$34 million in 1977. It is generally a small market for components; purchases include low-cost thyristors and triacs. The sewing machine industry, however, should have expanding requirements for electronic components during the next four years. The two leading sewing machine makers in Switzerland are Fritz Gegauf, Ltd. (Bernina brand) in Steckborn and Tavano AG (Elna brand) in Geneva.

Photographic equipment.—Photographic equipment made in Switzerland includes picture and movie cameras, projectors, electronic flash equipment, and photocopiers. Domestic production, which reached \$35 million in 1972, is meeting heavy competition from imports, particularly from Japan. It is expected to remain at about the same level during the next 5 years.

Television receivers.—Philips N.V. closed its television receiver assembly plant in La Chaux-de-Fonds in early 1973. This virtually ended Switzerland's TV equipment production with the exception of special custom and closed circuit television products. Output in 1972 was worth \$15 million. Studer and Lenco have discussed arrangements with the German firm AEG-Telefunken to produce television disc players, but labor shortages will probably inhibit production.

Military equipment sector.—Although it is small, the military equipment sector in Switzerland should not be overlooked as a market for electronic components. Several electronic equipment manufacturers produce military equipment in addition to other product lines. Military communications equipment is manufactured by Zellweger, Landis & Gyr in Zug, Siemens-Albis, and Autophon. Adolph Saurer AG in Arbon and Mowag Motorenfabrik AG in Kreuzlingen manufacture a variety of civilian and military vehicles and equipment.

Contraves AG, associated with Werkzeugmaschinenfabrik Oerlikon-Buehrle AG, develops munitions that are reportedly manufactured by its licensees abroad. It operates a standards agency in Zurich, however, and its choice of components for use in its manufacturing operations is largely based on what is available in the Swiss market.

The Competitive Environment

The strength of Switzerland's domestic electronic components industry lies chiefly in producing the more conventional passive components, including resistors, capacitors, relays and switches. Domestic production of the six groups of components covered in this survey is expected to double from \$26.1

million in 1972 to approximately \$52 million in 1977. Production in 1973 was valued at \$39.8 million.

Exports of components within the product category rose from \$12.8 million in 1972 to \$19.1 million in 1973. Swiss trade sources predict an average annual export rate of nearly 5% between 1974 and 1977. Exports in 1977 are expected to amount to nearly \$26 million.

Only three companies—Faselec S.A., Transistor AG, and Hasler AG—produce transistors and IC's in Switzerland. They supply about 8% of Swiss requirements, which totaled almost \$12 million in 1972. The market for these advanced components will probably continue to be supplied primarily by American firms from their U.S.- and European-based manufacturing facilities.

Switzerland's largest manufacturer of semiconductor devices is Faselec S.A., of Zurich; it employs 300 persons. The company is owned jointly by Philips of the Netherlands, AG Brown, Boveri & Cie and other Swiss watchmakers. It makes instruments and watch components for Philips and for domestic watchmakers. Faselec specializes in the production of linear type IC's and custom circuits. It turns out some 125 million transistors annually. About 80% of this output is sold on the open Swiss market, about 10% goes to Faselec's partners in Switzerland, and the rest is absorbed in foreign markets by the Philips group.

Transistor AG, in Zurich, a subsidiary of Raytheon, produces custom IC's and transistors, as well as diodes, rectifiers, and thyristors. Most of its limited output is sold to domestic users. The Swiss firm Hasler AG makes semiconductor devices primarily for its own use.

Standard Telephon und Radio AG (STR) produces capacitors, relays, and switches to serve its production needs. Metallux Elektronik AG in Chiasso (a subsidiary of the Italian company Mial) manufactures resistors, capacitors, and attenuation links for the Swiss market.

Swiss producers of relays and switches include: Elesta AG Elektronik in Bad Ragaz, W.G. Erni in Ostermungen, Ghielmetti AG in Solothurn, E. Jucker Relaisbau in Zurich, Lechmann und Muh Elektronik in Gumlingen, Micronel AG in Tagelswangen, Zettler-Elektro-Apparate AG in Nafels, Hasler AG, and Landis & Gyr.

The leading resistor manufacturers are: Contelec S.A. in Bienne; Ohmag in Neuchatel; Pryor Electronic S.A. in Ecublens; Hasler AG and Metallux Elektronik AG. Among the major manufacturers of capacitors are: Condensateurs Fribourg S.A., Fribourg; Leclanche S.A., Yverdon; Standard Telephon und Radio AG; and Micafil AG, Zurich (a Brown, Boveri & Cie subsidiary). Diodes and rectifiers are manufactured by Compagnie pour l'Industrie Radio-

technique, in addition to Transistor AG. The Swiss do not make color TV picture tubes.

Major foreign suppliers of components to Switzerland are: Germany's AEG-Telefunken, Klockner-Moeller, Semikron, Siemens, Tungstam, and Zettler; Holland's Philips; Italy's Mial; Britain's Morganite; and Belgium's Burndy.

U.S. firms active in Switzerland's electronic components market include Honeywell, ITT, Litton, RCA, Texas Instruments, TRW, Sprague, Union Carbide, Hewlett-Packard, Sperry Rand, Raytheon, Teledyne, and Motorola Semiconductors.

Switzerland is a member of the European Free Trade Association (EFTA) and the General Agreement on Tariffs and Trade (GATT), and has a preferential trade agreement with the European Economic Community (EEC). No duties are levied on imports of electronic components from EFTA members—Norway, Iceland, Portugal, Sweden, and Austria—or from the United Kingdom, Denmark, or Finland.

Import duties.—Duties imposed on component imports from non-EFTA countries range from 100 SwF to 200 SwF per 100 kilograms. As of January 1, 1974, all electronic component imports are assessed a tax of 6.6% of the frontier-crossing value. This tax is also imposed on the value of domestically produced components. An additional statistical tax of 3% is charged on all dutiable imports.

Information on official duty rates applicable to specific products within the product category may be obtained from the U.S. Department of Commerce,

Domestic and International Business Administration, Room 4217, Main Commerce, Washington, D.C. 20230.

Technical Requirements

The electrical power supply characteristics in Switzerland are 220/380 volts, 50 hertz, single- or 3-phase. Plugs are 2-wire, 3-wire, and 3-wire/ground types. All electrical equipment operating from a power line must bear the mark of approval of the Swiss Electrical Association (Schweizer Elektrotechnischer Verein—SEV). Customs officials are instructed to report any imported electrical equipment that does not bear this mark. The SEV offices are located at Seefeldstrasse 301, 8008 Zurich.

The metric system of weights and measures is the statutory standard in Switzerland.

Published national standards for electronic components in Switzerland may be obtained through the American National Standards Institute, Inc., 1430 Broadway, New York, N.Y. 10018.

The following market research study, upon which this Country Market Survey is based, is available on loan from the U.S. Department of Commerce, Domestic and International Business Administration, Room 1617M, Main Commerce, Washington, D.C. 20230:

"The Market for Electronic Components in Switzerland," DIB 74-03-502, November 1973.

Taiwan

Taiwan's swiftly expanding electronics industry, fueled by foreign investment and supported by the Government, is stimulating vigorous growth in demand for electronic components. Industry output of finished electronic products rose from \$301 million in 1972 to about \$360 million in 1973, a gain of approximately 20%. Production is expected to continue increasing at an average rate of 20% a year, approaching \$765 million in 1977.

The Taiwan market for the selected groups of electronic components covered in this

survey should keep pace with the overall industry expansion. Purchases of these components, which totaled \$107.7 million in 1973, are projected to rise, at an average annual rate of 18%, to more than \$210 million in 1977 (see table 1). Sharp increases in purchases took place in the 1969-72 period, when sales climbed from \$28.4 million to \$78.7 million.

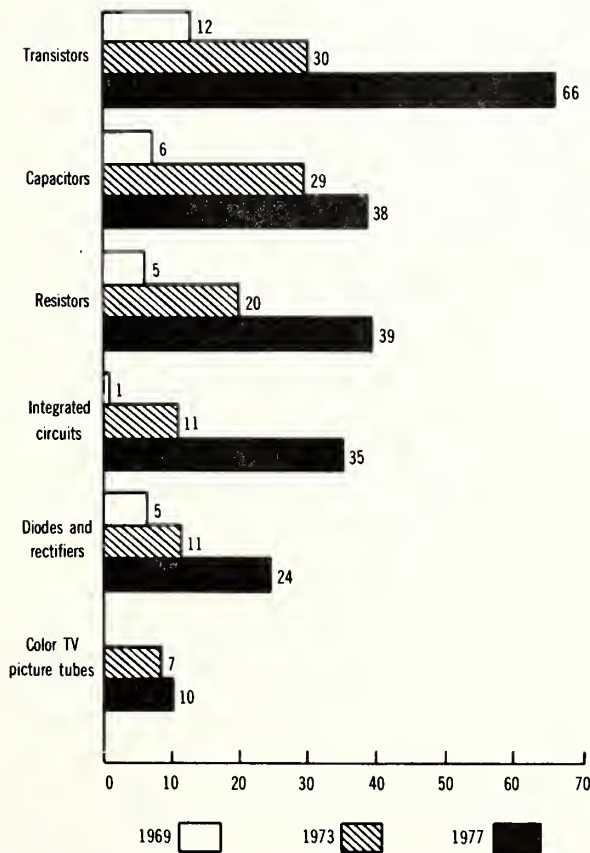
Annual imports of the six groups of components surveyed almost doubled between 1971 and 1973, rising from \$29 million to \$54 million. Imports are expected to expand at an average yearly rate of 11% from the 1973 level to nearly \$82 million in 1977.

The U.S. share of the Taiwan import market for product category components increased from 12% (\$3.4 million) in 1971 to 18% (\$7.2 million) in 1972 (see table 2). American manufacturers will find Taiwan to be an increasingly attractive market in the years ahead, as the country's electronics firms seek to upgrade product quality through the more extensive use of advanced electronic components.

The most significant third-country firms supplying electronic components to Taiwan are Japanese.

Taiwan: Size of market for selected groups of electronic components, 1969-77

(in millions of U.S. dollars)



Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

Sales Opportunities

Manufacturers of finished electronic products in

Product Category Definition

Electronic components covered in this survey are basically confined to resistors, capacitors, color TV picture tubes, diodes and rectifiers, transistors, and integrated circuits.

The term "product category" as used in this publication is limited to these six groups of components.

**Taiwan—Selected Indicators
(1972)**

Gross national product:	\$7.7 billion
Population:	15.3 million
Total country imports:	\$2.5 billion
Imports from U.S. (w/share of total):	\$543 million (22%)
Total country exports:	\$3 billion
Exports to U.S. (w/share of total):	\$1.3 billion (42%)
Exchange rate (May 1974):	37.88 new Taiwan dollars=US\$1

Taiwan are eager to diversify their sources of supply for electronic components and are looking particularly to the United States for devices not readily available from local factories. Propitious conditions favoring accelerated purchases of American-made electronic components are being reinforced by the policy of the Government of the Republic of China (ROC) to encourage imports from the United States in order to bring trade between the two nations into balance.

Taiwan's television receiver and radio industries, which in value terms account for roughly 67% and 16%, respectively, of the country's total output of electronic end products, will require increasing quantities of components as they continue their rapid expansion. In addition, manufacturers of calculators are expected shortly to become significant buyers of electronic components needed to maintain their swiftly rising production.

A market research survey recently conducted in Taiwan for the U.S. Department of Commerce, Office of International Marketing reveals that favorable sales opportunities exist for American exporters of the following electronic components:

Transistors.—Taiwan's market for transistors advanced more than 60% from 1971 (\$18.6 million) to 1973 (\$30 million). Sales are projected to increase at an average annual rate of better than 20% during the 1973-77 period, reaching \$66 million in the latter year.

Imports, which accounted for \$11 million, or 37% of the 1973 market, are forecast to rise to \$16 million in 1977. Purchases of U.S.-origin transistors in 1972 amounted to \$500,000, accounting for approximately 7% of that year's \$7-million import market.

Taiwan is currently experiencing a severe shortage of transistors. Although efforts are underway to increase domestic production, manufacturers will continue to rely heavily on imports to fill their rapidly expanding requirements. The best prospects

for U.S. exporters lie in silicon transistors, both small signal and n-p-n power types. American-made germanium power transistors will also be in demand.

Capacitors.—The capacitor market nearly tripled during the 1971-73 period, rising from \$10.4 million to \$29 million. The market is expected to reach an annual volume of \$38 million in 1977.

Taiwan's purchases of capacitors from abroad totaled \$20 million in 1973; this level should be maintained through 1977. Purchases from the United States in 1972 amounted to \$4.8 million, a 31% share of that year's \$15.5-million import market.

Taiwan's market for capacitors is expected to grow with the increased output of television sets and radios. A typical television receiver produced in the country contains 50 ceramic capacitors, 25 mylar capacitors, and 25 electrolytic capacitors; a radio typically incorporates 15 ceramic capacitors, 2 mylar capacitors, and 3 electrolytic capacitors.

The following capacitors should be in high demand:

- Fixed paper capacitors
- Fixed film capacitors
- Fixed ceramic capacitors
- Fixed electrolytic capacitors
- Variable capacitors

Resistors.—Purchases of resistors in Taiwan went up from \$6.3 million in 1971 to \$20 million in 1973, a more than threefold increase. The annual market is expected to climb to almost \$39 million in 1977.

Imports of resistors were valued at \$7.5 million in 1973 and should rise moderately to \$9 million in 1977. Purchases of resistors from the United States amounted to \$259,000 in 1972, representing 4% of the import market.

Demand for resistors should remain high, in line with the expected continued growth of consumer electronics production. Television receivers produced in Taiwan generally contain approximately 120 resistors and radios in most cases incorporate about 30.

Types of resistors offering promising sales prospects for American exporters include:

- Variable wirewound resistors
- Fixed composition resistors
- Fixed film resistors
- Fixed wirewound resistors

Carbon resistors are generally supplied by local manufacturers, but Taiwan's expanding requirements for special wirewound or precision resistors should be met largely by imports, mainly from the United States.

Integrated circuits.—Sales of integrated circuits in Taiwan experienced the highest growth rate of any single group of components within the product category during the 1971-73 period, rising from a modest level of \$2 million to \$10.9 million. The

market is expected to increase at an average annual rate of about 33% between 1973 and 1977, reaching almost \$35 million in the latter year.

Imports are expected to grow an average of more than 65% a year, going from \$1.9 million in 1973 to nearly \$15 million in 1977. The United States, by far Taiwan's leading foreign supplier of integrated circuits, held a 79% share of the 1972 import market. Purchases of U.S.-made integrated circuits amounted to \$710,000 in that year.

The color television receiver and calculator industries will represent the principal growth markets in Taiwan for integrated circuits during the next 5 years. U.S. technological superiority in integrated circuits should continue to give American manufacturers a competitive edge in this segment of the market. The following types of IC's present the best sales opportunities for U.S. manufacturers:

- Monolithic digital integrated circuits
- Hybrid integrated circuits
- COS/MOS digital integrated circuits
- Linear integrated circuits

Diodes and rectifiers.—Taiwan's expenditures for diodes and rectifiers doubled from \$5.4 million in 1971 to \$10.8 million in 1973. Sales of these devices are expected to follow the steady upward growth trend of the electronics industry as a whole. Projected increases, averaging more than 20% a year, should result in a 1977 market of \$24 million.

Imports accounted for 61%, or \$6.6 million, of the 1973 market. The import market is expected to advance 82% during the 1973-77 period, reaching \$12 million in the latter year. Purchases of diodes and rectifiers from the United States in 1972 accounted for \$875,000, or 16% of the \$5.5-million import market.

The country's electronics producers will continue to look to the United States for a variety of advanced diodes and rectifiers which local producers are not in a good position to supply. Power rectifiers, zener diodes, and silicon rectifier diodes are considered as having the best sales prospects for U.S. suppliers during the next 5 years.

Color TV picture tubes.—Taiwan's consumption of color TV picture tubes is anticipated to advance about 43% from \$7 million in 1973 to \$10 million in 1977. Purchases totaled \$3 million in 1971.

Because there is no significant local production of color TV picture tubes in Taiwan, the country's manufacturers of color TV receivers are virtually dependent on imports to fill their tube requirements.

Although Japan is presently Taiwan's largest supplier of color TV picture tubes, imports from the United States amounted to \$238,000 in 1971, or 8% of the import market. Purchases of these tubes from U.S. firms were minimal in 1972. However, they are expected to increase appreciably in the next few years, as several consumer electronics

Taiwan—The Electronics Industry Basic Data (1972)

Total value of production (est.):	\$460 million
Number of manufacturers:	425
Industry labor force:	122,082
Output of principal electronic components user industries—	
Consumer products industries:	
television sets	\$201 million
radios	\$49 million
phonographs	\$4 million
tape recorders	\$13 million
calculators	\$12 million
Industrial/commercial equipment industries:	
telephones	\$2 million
switchboards	\$6 million

companies in Taiwan are considering the production of color TV's for export to the United Kingdom and, possibly, the United States.

Other electronic components.—U.S. suppliers should find excellent sales opportunities in Taiwan for a number of electronic components outside the product category. A sizable market is emerging for special semiconductor devices, such as light-emitting diodes (LED's), photosensors, and thermionic devices. In 1972, this market was valued at \$2.8 million. Demand for LED's and other electronic display devices will rise substantially as a result of expanded production of calculators.

Connectors, switches, and inductors will also be in demand. Interest is growing in high-quality connectors and innovative switching devices for use in radios and radio/phonograph/tape recorder combinations. Sales of connectors amounted to \$9 million in 1972; relays and switches, \$26 million; and inductors, \$48 million.

Selected End-User Industries

Taiwan's 217 manufacturers of finished electronic products employed a total of 52,082 persons in 1972. Their aggregate output in that year exceeded \$301 million. The consumer products sector accounts for approximately 97% of the country's total output of finished electronic products. This sector purchases the bulk of the electronic components consumed in Taiwan. The industrial/commercial equipment sector accounted for a modest 2.9% share of total 1972 output of finished electronic products. The sector's production is confined to a limited line of telecommunications equipment.

The ROC Government's long range development plan for the electronics industry (1973-83) emphasizes the importance of growth in the coun-

Table 1.—Taiwan: Size of market¹ for selected groups of electronic components, 1969-77
(in millions of U.S. dollars)

Description	1969	1971	1972	1973	1974	1977
Production ²	1.0	2.0	7.0	12.8	15.0	30.0
Imports	3.8	4.5	7.0	7.5	8.0	9.0
Exports	—	.2	.2	.3	.4	.4
Market size	4.8	6.3	13.8	20.0	22.6	38.6
<i>Capacitors</i>						
Production ²	7.3	8.2	12.4	18.0	20.0	30.0
Imports	3.9	11.2	15.5	20.0	21.0	20.0
Exports	5.0	9.0	9.5	9.0	9.0	12.0
Market size	6.2	10.4	18.4	29.0	32.0	38.0
<i>Color TV picture tubes</i>						
Production	—	—	—	—	—	—
Imports .....	.1	3.0	5.1	7.0	8.0	10.0
Exports	—	—	—	—	—	—
Market size .....	.1	3.0	5.1	7.0	8.0	10.0
<i>Diodes and rectifiers</i>						
Production ²	5.0	7.5	11.0	13.0	18.7	41.2
Imports	3.8	4.4	5.5	6.6	7.9	12.0
Exports	4.0	6.5	7.5	8.8	13.5	29.6
Market size	4.8	5.4	9.0	10.8	13.1	23.6
<i>Transistors</i>						
Production ²	7.9	14.4	22.5	22.0	31.0	60.0
Imports	4.5	5.5	7.0	11.0	10.2	16.0
Exports .....	.9	1.3	2.0	3.0	4.2	10.0
Market size	11.5	18.6	27.5	30.0	37.0	66.0
<i>Integrated circuits</i>						
Production ²	9.0	19.6	37.0	52.0	64.0	120.0
Imports	*	.4	.9	1.9	3.6	14.8
Exports	8.0	18.0	33.0	43.0	50.0	100.0
Market size	1.0	2.0	4.9	10.9	17.6	34.8
<i>Totals</i>						
Production ²	30.2	51.7	89.9	117.8	148.7	281.2
Imports	16.1	29.0	41.0	54.0	58.7	81.8
Exports	17.9	35.0	52.2	64.1	77.1	152.0
Market size	28.4	45.7	78.7	107.7	130.3	211.0

¹ Size of market equals production plus imports minus exports. Parts and accessories not included.

² Production figures include components manufactured by OEM's for their own use. In-house production of resistors represents 11% of the total; capacitors, 8%; diodes and rectifiers, 8%; transistors, 8%; and integrated circuits, 12%.

* Less than \$50,000.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

try's consumer electronics industry. The plan fosters the production of components and parts necessary to manufacture such consumer products as televisions, radios, stereos, and desk calculators in order to build a firm foundation for the country's electronics industry as a whole. The goals of the plan also include the development and manufacture of more sophisticated electronic instruments and communications equipment.

The Government offers a number of incentives to industry, such as exemptions from corporate taxes or accelerated depreciation of fixed assets. In addition, capital equipment may be exempted under certain conditions from import duties; import tariffs on raw materials paid by export industries may also be refunded.

Foreign investment generally is encouraged by the Government. Of the \$85 million in foreign investments approved during the first half of 1973, approximately one-fourth (\$21 million) was committed to the electronics industry.

Consumer products sector.—The consumer products sector of Taiwan's electronics industry in 1972 comprised 207 factories, with employment totaling some 50,000. The sector's annual output amounted to \$292 million in 1972 and is expected to surpass \$680 million in 1977.

Taiwan's television receiver industry accounted for 72% of the sector's total production in 1972. The radio industry contributed 18% of sector output in the year, and the tape recorder industry 5%. Production of calculators, only minimal at the beginning

of this decade, represented 4% of the sector's total 1972 output.

Television receivers.—The television receiver industry in Taiwan comprises 26 factories, employing a total of 21,000 people. Output was valued at \$201.1 million in 1972. Production of TV sets increased an average of 111% a year during the 1966-72 period, rising from 66,000 sets to 3.6 million sets. About 500,000 color TV sets were made in 1972.

Four of the country's leading television receiver manufacturers are subsidiaries of U.S. firms: RCA Taiwan, Ltd., Taipei; Admiral Overseas Corporation, Taipei County; Zenith Taiwan Corporation, Tao Yuan County; and Motorola Taiwan Electronics Corporation, Taipei County.

RCA is Taiwan's largest producer of TV sets, accounting for 20% of total annual production. The company, employing some 5,000 persons, makes TV components and integrated circuits, in addition to television receivers.

Admiral, which accounts for about 12% of Taiwan's television receiver output, employs over 2,000 people in the manufacture of both monochrome and color TV sets. Zenith, with some 2,000 employees, contributes approximately 9% of the country's total TV set production, while Motorola's share of overall production is 2%. Motorola's 900 employees make radios, phonographs, tape recorders, and video tape recorders, in addition to television sets.

Other major manufacturers include the Tatung Company; Sanyo Electric (Taiwan) Co., Ltd., and Matsushita Electric (Taiwan) Co., Ltd., all headquartered in Taipei.

Tatung Company, Taiwan's largest producer of consumer electronic products, holds the second largest share (13%) of TV set output. The company only recently began to export black-and-white and color televisions under its own name and

is striving for annual exports of 60,000 color and 150,000 monochrome receivers to the United States by 1977, including private label as well as Tatung brands.

Taiwan's television receiver industry is geared to the international market; about 88% of its annual production is exported. Exports of monochrome televisions to the United States alone amounted to 2.7 million sets in 1972. Sanyo is reportedly selling about 10,000 color TV sets a month to the United States. Expanding overseas markets, coupled with rising domestic demand, should ensure a healthy future for Taiwan's manufacturers of television sets. Output is expected to grow at a yearly rate of between 15 and 25% through 1977.

Radios.—There are 83 firms, with a total of 17,335 employees, engaged in the manufacture of radios in Taiwan. Output by these companies rose from 4.3 million radios in 1971 to 6.1 million in 1972, a 41% increase. Production of radios in the latter year was valued at \$48.7 million.

U.S. subsidiaries manufacturing radios in Taiwan include Arvin (Taiwan) Ltd., in Tao Yuan County; Bendix Taiwan, Ltd., in Tao Yuan County; Motorola; Philco-Ford Taiwan Corporation, in Taipei County; Trans-World Electronics (Taiwan), Ltd., in Taipei County; Leco Electronics Corporation in Taipei; and Taiwan Hi-Sonic Co., Ltd., in Taipei.

Taiwan's radio manufacturers, like the TV set producers, are export-oriented; over 50% of their total annual output is sold in foreign markets. Expansion of production is expected to continue in response to rapidly rising domestic and international demand for solid state radios. The Funai Electric Company, for example, will begin construction in 1974 of a \$300,000 plant for the manufacture of transistor radios.

Other consumer products.—There are some 40 firms in Taiwan manufacturing tape recorders and 15 companies making phonographs. Total output of tape recorders reached 779,000 units valued at \$12.8 million in 1972. The 1972 level represents a 131% increase over the 337,000 tape recorders produced in 1971. Phonograph production experienced more than a 65% average yearly increase in the 1966-72 period, rising from 9,000 units to 199,000 units. The value of the 1972 output was almost \$4 million.

The tape recorder and phonograph industries should grow moderately throughout the remainder of this decade. Pioneer Electronics, a small manufacturer of speaker units, plans to branch out into the production of automobile stereos in 1974. Expansion plans of the Taiwan Capetronic Corporation now underway include construction of a \$330,000 plant for the fabrication of multiplex stereophonic phonographs.

Table 2.—Taiwan: Imports from the United States, and U.S. share of total imports, of selected groups of electronic components, 1969-72¹

(in thousands of U.S. dollars)

	1971		1972	
	Value (percent)	U.S. share	Value (percent)	U.S. share
Resistors	214	5	259	4
Capacitors	336	3	4,854	31
Color TV picture tubes	238	8	—	—
Diodes and rectifiers ..	2,000	46	875	16
Transistors	375	7	500	7
Integrated circuits	280	70	710	79
Total	3,443	12	7,198	18

¹ Parts and accessories not included.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

The manufacture of desk and pocket calculators increased dramatically from virtually no production a few years ago to \$12.4 million in 1972, in which year 21 firms with over 3,000 workers were making calculators. Major producers include Wang Laboratories (Taiwan), Ltd.; Leco Electronics Corporation; Hodaka Taiwan Electronics Corporation; Oscars Electronic Industries, Inc.; and Qualitron Industries Corporation. All five firms are based in Taipei.

Industrial/commercial equipment sector.—The industrial/commercial equipment sector in 1972 comprised 10 factories employing a total of 2,256 persons. Production amounted to \$8.6 million in that year and consisted mainly of telephones, telephone switchboards, signal generators, oscilloscopes, transceivers, direction finders, fish finders, radio buoys, alarms, and meters. Output by this sector is expected to approach \$55 million in 1977, reflecting an average annual growth rate of about 45% for the 1972-77 period.

The Government's 10-year development plan for the electronics industry calls for increased production of more sophisticated electronic instruments and communications equipment. Priority will be given to realizing production capability for mini-computer peripherals, computer terminals, X-ray apparatus, telephone and telegraph apparatus, numerical control systems, electronic measuring instruments, and process control and industrial meters.

Telecommunications equipment.—Taiwan's five telecommunications equipment manufacturers, employing a total of 1,842 workers, all produce telephones. One firm also makes a telephone message register and counter, and two companies fabricate switchboards. Output of telephones rose from \$1.3 million (66,478 units) in 1971 to \$1.6 million (79,670 units) in 1972. Switchboard production reached \$6.1 million in 1972, up from \$4.9 million in the previous year.

The Tatung Company, the largest telephone apparatus manufacturer in Taiwan, also produces a wide range of other electronic products. Tatung is the only telecommunications company that produces some of its own electronic components; the other telephone equipment firms rely almost completely on imported devices.

The Tongya Telecommunication Industry Co., Ltd., with 160 workers, manufactures coin telephones and telephone message registers and counters. Other manufacturers of telecommunications equipment in Taiwan are the United Electric & Machinery Manufacturing Corporation, Taiwan Telecommunication Co., Imperial Industrial Corporation, and Power Electronics Co., Ltd. All are based in Taipei except Imperial, which is located in Tao Yuan County.

The policy of the ROC Government is to stim-

ulate investments in the local telecommunications equipment industry to improve its technological development and productivity in the interest of increased exports. Consistent with this policy, the Government is placing great emphasis on the production of sophisticated telecommunications equipment for which foreign demand is greatest. This implies a sharp rise in the industry's demand for advanced U.S. electronic components, which enjoy a high degree of acceptance in Taiwan.

The Competitive Environment

Taiwan's production of the selected groups of electronic components covered in this survey more than doubled in the 1971-73 period, rising from \$51.7 million to \$117.8 million. Output is expected to exceed \$280 million in 1977.

The country's manufacturers of components are highly export-oriented; more than 50% (\$64.1 million) of 1973 output of product category components was sold in foreign markets. Exports are expected to total \$152 million in 1977.

Foreign subsidiaries, primarily of U.S. and Japanese firms, are the most important producers of electronic components in Taiwan. The country's electronic components industry comprises 208 companies, employing a total of some 70,000 people. Of these, 33 firms are subsidiaries of U.S. companies, together employing 45% of the industry's total work force. Subsidiaries of Japanese companies number 35 and account for 30% of industry employment. About 5% of the work force is employed in other foreign-owned firms, and 20% in locally capitalized companies.

Many major producers of electronic components in Taiwan are making determined efforts to increase production to capture a larger share of rapidly expanding export markets, as evidenced by the expected 23% average annual increase in the country's output of IC's during the 1973-77 period. Annual output of IC's is predicted to climb from \$52 million to \$120 million in that period. Among the country's leading producers of IC's are: Asionics Taiwan, Inc.; China Semiconductor Corp.; Fine Products Microelectronics Corp.; Orient Semiconductor Electronics, Ltd.; Philips Electronics Building Elements Industries (Taiwan), Ltd.; and RCA Taiwan, Ltd. All are located in Taipei with the exception of Orient Semiconductor, which is in the Nantze export processing zone.

Domestic production of capacitors also is expected to increase sharply in the 1973-77 period, expanding from \$18 million to \$30 million. Important Taiwan producers of capacitors are: Asuno Electronics Corp., Taichung; Cathay Electronics Industrial Co., Taipei; Cen-Ter Electronic Co., Ltd., Nan Tou County; Centric Industry Co., Ltd., Tai-

pei County; and Cornell-Dubilier Electronics (Taiwan), Inc., Tao Yuan County. Alps Electric plans to expand its manufacturing facilities for capacitors, as well as for tuners and switches.

Domestic production of resistors, which supplies a large share of the home market, should reach \$30 million in 1977. This would reflect an average annual growth of 24% from the 1973 level of \$12.8 million. Taiwan's major producers of resistors include Alexandria Enterprise, Ltd., Taipei; An Hsing Industry Co., Ltd., Tao Yuan; Atlas Electronics (Taiwan), Ltd., Taipei; and First Resistor & Condenser Co., Ltd., Taipei.

Manufacturers of transistors in Taiwan recorded production valued at \$22 million in 1973. Domestic production is expected to climb to \$60 million in 1977. Unitron Industries Corp., Ltd., in Hsin Chu County, and General Instrument of Taiwan Ltd., in Taipei, are among the country's important manufacturers of transistors.

Government support generous.—The Government of the Republic of China has actively encouraged the development of the electronics industry. There are two government-operated research organizations in Taiwan devoted to electronics—the Telecommunications Laboratories of the Ministry of Communications and the Union Industrial Research Institute (UIRI) of the Ministry of Economic Affairs.

The Telecommunications Laboratories consist of a transistor lab, a switching lab, and a computer center. They are staffed with a total of 38 researchers and 24 technicians. The UIRI facilities include laboratories for environmental tests, physical characteristics tests, and electrical characteristics tests. The UIRI started quality testing of resistors, capacitors, coils, transformers, and loudspeakers in 1971.

The Engineering College of National Chiao Tung University employs 83 researchers in 8 laboratories devoted to research and development of various electronic components and equipment, including semiconductors, switching devices, microwave communications equipment, computers, and controls. At the Engineering College of National Taiwan University, 18 researchers work in laboratories specializing in radio wave propagation research, materials testing, and computer and solid state electronics research.

The ROC Government also has set up an Electronics Industry Development Committee under the Council for International Economic Cooperation and Development. The Committee is headed by the Director-General of the Directorate General of Telecommunications of the Ministry of Communications and includes 14 members from relevant Government agencies, academic institutions, and industry. Under the direction of the Committee, a survey of the technical aspects of the industry was undertaken in 1971.

The Government assists investors in components production in a variety of ways. The Chinese Productivity Center gives technical assistance to investors in the electronics industry. The Government has instructed banks to increase funds and simplify lending procedures for small and medium-size electronics firms. Electronic components manufacturers who intend to export their total production may locate their factories in export processing zones or establish bonded factories to qualify for duty exemptions on imported raw materials or semifinished products. Such manufacturers are also entitled to either a 5-year exemption on corporate taxes or accelerated depreciation of fixed assets.

The Government's electronics industry development plan stresses the importance of domestic electronic component production to the development and expansion of Taiwan's consumer electronics industry. The manufacture of integrated circuits for electronic computers and electronic switching systems is also being encouraged.

U.S. market penetration could increase.—Taiwan's manufacturers of electronic end products are eager to receive more information about U.S.-made electronic components, especially regarding their availability, price, and delivery times. The most effective method of selling components in Taiwan is by competent on-the-spot representation. U.S. producers of components that provide applications assistance, particularly in such areas as calculator production, will find themselves in a strong selling position vis-à-vis the Japanese, the main competitors of U.S. suppliers in the Taiwan market.

Among the U.S. firms presently exporting electronic components to Taiwan are Cornell-Dubilier Electric Corp.; RCA Corporation; Better Coil and Transformer Corp.; Motorola Semiconductor Products, Inc. and Fairchild Semiconductors. Other American electronic component producers active in the Taiwan market are General Instrument Corporation; P. R. Mallory & Co., Inc.; and GTE Sylvania, Inc.

U.S. suppliers face their stiffest competition from Japanese firms in the Taiwan market. Among the Japanese manufacturers who have successfully entered the expanding Taiwan electronic components market are the Matsushita Electric Industrial Co., Ltd.; Sanyo Electric Co., Ltd.; Hitachi Co., Ltd.; and Mitsumi Co. Other Japanese suppliers are TDK Electronics Co., Ltd.; and Asuno Electronics; Toko, Inc.; and Nippon Electric Co., Ltd.

Import duties.—Import duties on electronic components are levied on the cost, insurance, and freight (c.i.f.) value plus 20%. Rates on components range from 7% to 33%. In addition, harbor dues on sea shipments normally amount to 3% based on the duty-paid value. The Taiwan Garrison Command, a

military authority controlling the sale and manufacture of radio and communication equipment in Taiwan, requires advanced registration of imported electronic equipment.

Information on official import duty rates and regulations applicable to specific products within the product category may be obtained from the U.S. Department of Commerce, Domestic and International Business Administration, Room 4217, Main Commerce, Washington, D.C. 20230.

Technical Requirements

The characteristics of electrical power supply in Taiwan are 110/220 volts, 60 hertz, single- or 3-phase.

Although the metric system of weights and meas-

ures is the legal standard, the English system is commonly used.

Published national standards for electronic components in Taiwan are currently being prepared by the Chinese National Bureau of Standards.

The following market research study, upon which this Country Market Survey is based, is available on loan from the U.S. Department of Commerce, Domestic and International Business Administration, Room 1617M, Main Commerce, Washington, D.C. 20230:

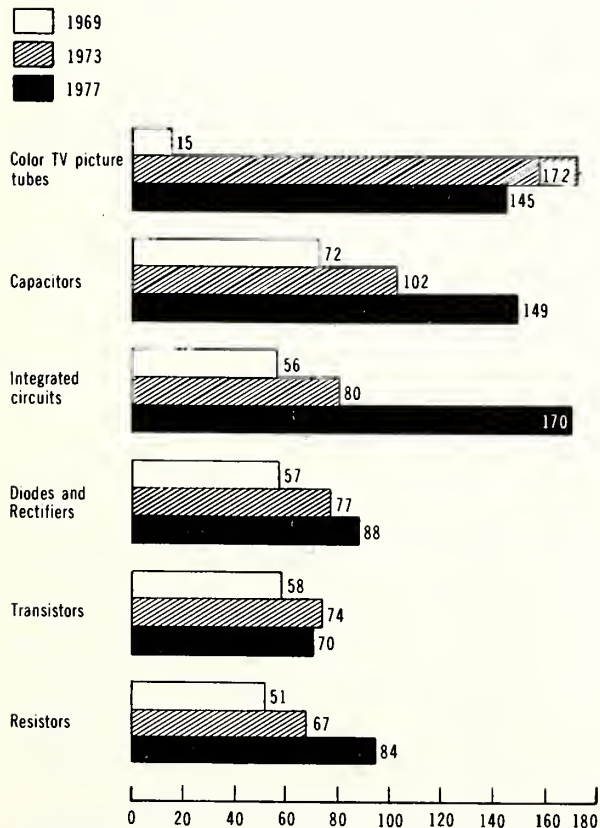
"The Market for Electronic Components in Taiwan," DIB 74-06-506, November 1973.

United Kingdom

Rising demand among the United Kingdom's consumer, industrial commercial, and military sectors for finished electronic products should increase sales of all types of electronic components by 30% between 1973 and 1977. Purchases in 1977 are expected to exceed \$1.3 billion, compared with \$1 billion in 1973. Sales in 1973 of the selected groups of electronic components covered in this survey totaled \$572 million, an increase of 50% over the 1971 figure of \$381 million (see table 1). The market is forecast to rise at an average annual rate of nearly 17% and exceed \$700 million in 1977.

United Kingdom: Size of market for selected groups of electronic components, 1969-77

(in millions of U.S. dollars)



Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

British total imports of product category components more than doubled between 1971 and 1973, climbing from \$121 million to \$248 million. The import market is forecast to exceed \$260 million in 1977. With increasing shares of domestic production being channeled to Britain's export markets, imports will fill a growing proportion of home demand. The import share of the market was 32% in 1971; it rose to 43% in 1973, and should level off at around 37% by 1977.

The United States was Britain's leading supplier of components within the product category in 1972, holding a 24% share of the import market (see table 2). Although imports from the United States increased from \$39 million in 1969 to \$41 million in 1972, the U.S. share of British imports declined from 48% to 24% during the same period. This drop is attributable largely to increasing British purchases of product category components from European- and Asian-based manufacturing subsidiaries of U.S. firms.

Other major foreign suppliers of product category components to the United Kingdom are Germany, Japan, and the Netherlands.

Product Category Definition

Electronic components covered in this survey are basically confined to resistors, capacitors, color TV picture tubes, diodes and rectifiers, transistors, and integrated circuits.

The term "product category" as used in this publication is limited to these six groups of components.

**United Kingdom—Selected Indicators
(1972)**

Gross national product:	\$135 billion
Population:	56 million
Total country imports:	\$28 billion
Imports from U.S. (w/share of total):	\$3 billion (10%)
Total country exports:	\$24 billion
Exports to U.S. (w/share of total):	\$3 billion (12%)
Exchange rate (May 1974):	0.42 pounds=US\$1

Sales Opportunities

Manufacturers of electronic products in the United Kingdom will spend almost \$3 billion on electronic components during the 1974-77 period. Imports are expected to account for more than one-third of this consumption. U.S. suppliers have particularly favorable sales prospects in the British market, largely because of the competitive advantages derived from their technological capability to develop new and more sophisticated components.

A market research survey recently conducted in the United Kingdom for the U.S. Department of Commerce, Office of International Marketing reveals that favorable sales opportunities exist for American exporters of the following electronic components:

Color TV picture tubes.—Sales of color TV picture tubes rose 137% during the 1971-73 period, advancing from \$72 million to \$172 million. Due to saturation of the market for color TV's, however, market analysts forecast a drop in sales to \$145 million in 1977.

Imports of color TV picture tubes more than tripled in value between 1971 and 1973, climbing from \$25 million to \$78 million. They accounted for more than 45% of domestic consumption in the latter year. Increased domestic production of color TV picture tubes and diminishing demand for new color TV sets are expected to cause a decline in imports to \$26 million by 1977. Best sales prospects are forecast for 110° deflection tubes, which TV set makers are now using in most large-screen models, and precision in-line (PIL) bonded yoke tubes, which are used for the smaller sets.

Capacitors.—The British market for capacitors is presently characterized by supply shortages, due primarily to the recent upsurge in color TV receiver production. Sales totaling more than \$85 million in 1971 advanced nearly 20% to over \$102 million in 1973. Overall sales growth of 10% a year is forecast during the 1973-77 period, with the market

projected to reach almost \$150 million in the latter year.

British purchases of foreign-made capacitors increased 85% during the 1971-73 period, climbing from \$21 million to almost \$40 million. Imports are projected to increase at an average rate of 13% a year from the 1973 level, reaching \$65 million in 1977. The leveling off of demand for color TV sets is expected to ease the tight supply situation for certain types of capacitors. Electrolytic and chip capacitors, however, will continue in high demand.

The British market for electrolytic capacitors is projected to expand approximately 10% a year. A growing market is also forecast for chip capacitors used with thick and thin film hybrid integrated circuits. Demand for these devices is expected to advance with the growing market for hybrid IC's at an average rate of about 8% a year.

Integrated circuits.—The market for integrated circuits in the United Kingdom increased 78% between 1971 and 1973—from \$45 million to \$80 million. The development of more specialized IC's for an increasing number of applications is expected to boost sales to \$170 million in 1977. This would represent an average growth rate of 21% a year.

Imports of IC's, which more than doubled from over \$20 million in 1971 to \$42 million in 1973, are projected to increase at an average rate of almost 16% a year over the next 4 years. They are projected to reach \$75 million in 1977. Highly specialized U.S.-made IC's are expected to have a competitive edge over those produced by other countries. Local trade sources forecast that British demand will be strongest for the following integrated circuit packages:

- TTL (MSI)
- CMOS
- Linears
- 1024-bit P-Channel RAM (1103)
- 1,024-bit N-Channel RAM
- 1K-8K ROM
- 4K N-Channel RAM
- STTL
- ECL
- Power Darlingtons

British computer manufacturers are expected to move toward the use of semiconductor rather than core memories over the next 5 years. This will increase the demand for the 1103 1,024-bit dynamic RAM. The major part of this market will continue to be met by imports, chiefly from the United States and Canada. The introduction of the 4K N-channel RAM has stimulated development of computer memories using this device. It is expected that large quantities will be needed by 1975.

Imported 1,024-bit static N-channel MOS RAM's will find a growing market outside the main memory area, at least through 1975. The ECL 10K

range has been generally adopted for high-speed logic in large CPU memories; Schottky TTL is being used in memories of smaller computers. Favorable market prospects are also seen for single chip parallel processors used with bipolar RAM's and ROM's for microprogramming.

Development of inexpensive IC logic has significantly increased the use of digital circuitry in industrial control instruments. The advent of LSI is expected to further hasten this process. The use of MOS microprocessing in industrial controls is also predicted to grow rapidly during the next 5 years. CMOS is currently being substituted for TTL in an increasing number of circuit designs.

The British Post Office Corporation, which controls the country's telecommunications system, is replacing its older exchange equipment with electronically controlled reed-relay exchanges. This is increasing the demand for bipolar saturate logic circuits. Conventional dial telephones are also being replaced by the pushbutton variety, generating new market opportunities for MOS shift registers and logic. Once pushbutton phones become established, the use of extra facilities such as automatic dialing equipment, memory for common-code storage, and facsimile equipment will also rise and stimulate demand for advanced IC's.

Other major developments in telecommunications are the introduction of pulse-code and pulse-compression multiplexing in high traffic areas and the use of microwave and laser links over distances of up to 100 miles. Current efforts to develop megabit-rate pulse code modulation (PCM) transmission could open a substantial market for ECL within the next 5 years. These developments will require TTL for slow-speed PCM systems, fast bipolar logic for PCM equipment, and MOS "bucket-brigade" analog serial memories for pulse compression. Demand by the telecommunications industry during the next 5 years will also be strong for lower power TTL for test equipment, linear amplifiers for handsets, and phase-lock loop IC's for tone decoders.

Britain's expanding production of such communications equipment as small radar systems, paging systems, and long-range military and civilian portable transceivers points toward growing sales of fast digital logic IC's, IC's for linear IF, audio amplifier, and voltage regulator applications, and low-power linear IC's.

There are now five or six IC's in each color television set; the average should reach 10 per set during the next 2 to 5 years. Development of more complex circuits combining the functions of two or more IC's will hold IC content at that level.

IC's are expected to be used more extensively during the next 5 years in audio equipment, particularly in automobile entertainment systems and in

United Kingdom—The Electronics Industry Basic Data (1972)

Total value of production:	\$3.2 billion
Number of manufacturers:	Over 300 medium-to-large firms
Industry labor force (est.)	450,000
Output of principal electronic components user industries—	
Consumer products industries:	
broadcast receiving and sound reproduction equipment	\$707 million
pocket calculators	\$4 million
photographic equipment	\$160 million
Industrial/commercial equipment industries:	
computers and related equipment	\$511 million
telecommunications equipment	\$1,175 million
measuring and testing instruments	\$112 million
medical electronic equipment	\$18 million

quadrasonic sound systems for the home. Other consumer electronic products with high potential for expanded use of IC's include the following: pocket calculators; exposure controls in cameras; domestic appliances such as washing machines, food mixers, and light dimmers; electronic musical instruments and toys; and electronic security systems.

The British automotive industry offers improving prospects for the application of IC technology in the following systems: fuel injection (ROM/PLA/custom-microprocessor); antiskid braking (CMOS/bipolar digital and bipolar linear); seat-belt interlocks (CMOS/bipolar custom); safety and warning devices ("photo" switches and MOS or bipolar logic); electronic ignitions (proximity switch devices involving thyristor trigger output); electronic transmission controls (MOS or bipolar digital IC's); tachometers/odometers (bipolar digital counter); and alternator regulators (monolithic IC's).

Britain is second only to the United States in the manufacture of aerospace equipment. This industry provides a growing market for high-quality IC's, particularly for TTL, interface ROM's, and power-driving IC's. Military control and communications systems manufactured in the United Kingdom also have a high microcircuit content and provide a good market for U.S. suppliers of IC's.

Diodes and rectifiers.—The market for diodes and rectifiers amounted to \$54 million in 1971 and rose

Table 1.—United Kingdom: Size of the market¹ for selected groups of electronic components, 1969-77
(in millions of U.S. dollars)

Description	1969	1971	1972	1973	1974	1977
<i>Resistors</i>						
Production ²	48.0	54.5	51.1	55.8	61.4	69.7
Imports	11.3	12.9	20.1	23.3	27.0	31.0
Exports	8.4	3.1	8.0	11.7	14.0	17.0
Market size	50.9	64.3	63.2	67.4	74.4	83.7
<i>Capacitors</i>						
Production ²	63.4	75.4	68.8	75.6	83.0	108.0
Imports	16.1	21.3	26.8	39.5	48.0	65.0
Exports	7.4	11.3	8.5	12.8	17.0	24.0
Market size	72.1	85.4	87.1	102.3	114.0	149.0
<i>Color TV picture tubes</i>						
Production ²	10.5	52.5	81.4	127.5	148.8	195.5
Imports	5.5	25.3	47.5	78.0	48.8	26.0
Exports	1.3	5.4	17.6	34.0	29.3	76.5
Market size	14.7	72.4	111.3	171.5	168.3	145.0
<i>Diodes and rectifiers</i>						
Production ²	51.2	45.6	57.4	60.5	68.0	68.8
Imports	11.0	13.1	19.0	25.6	29.0	29.0
Exports	5.0	4.5	5.0	9.3	11.0	9.4
Market size	57.2	54.2	71.4	76.8	86.0	88.4
<i>Transistors</i>						
Production ²	46.7	41.5	52.1	61.6	62.7	56.7
Imports	21.5	27.6	29.3	39.6	41.0	36.0
Exports	10.3	8.9	11.1	26.8	27.0	23.0
Market size	57.9	60.2	70.3	74.4	76.7	69.7
<i>Integrated circuits</i>						
Production ²	45.8	33.3	54.9	61.0	86.2	151.2
Imports	15.3	20.4	25.5	41.9	49.0	75.0
Exports	4.9	9.0	11.7	23.3	32.0	56.0
Market size	56.2	44.7	68.7	79.6	103.2	170.2
<i>Totals</i>						
Production ²	265.6	302.8	365.7	442.0	510.1	649.9
Imports	80.7	120.6	168.2	247.9	242.8	262.0
Exports	37.3	42.2	61.9	117.9	130.3	205.9
Market size	309.0	381.2	472.0	572.0	622.6	706.0

¹ Size of the market equals production plus imports minus exports. Parts and accessories not included.

² Production figures include components manufactured by OEM's for their own use. In-house production of resistors and transistors is negligible; in-house production of capacitors represents 5 to 10% of the total; color TV picture tubes, 40 to 45%; diodes and rectifiers, 5 to 10%; and integrated circuits, under 5%.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

42% to almost \$77 million in 1973. Sales are expected to reach close to \$90 million in 1977.

Imports, which increased 95% between 1971 and 1973 (from \$13 million to almost \$26 million), are projected to reach about \$30 million in 1974 and remain at that level through the 1974-77 period.

Trade sources report good prospects for sales of high-power rectifiers to Britain's industrial electronic equipment sector. The market outlook for low-current devices is also good in the short term but will diminish as IC's take their place. The market for signal diodes and rectifiers is forecast to remain stable through 1977.

Transistors.—Annual transistor sales, which rose 24% from \$60 million in 1971 to over \$74 million

in 1973, are expected to drop gradually to \$70 million by 1977.

Similarly, imports, which enjoyed a 44% increase between 1971 and 1973, rising from about \$28 million to \$39 million, are expected to peak at about \$41 million in 1974 then decline to an estimated \$36 million in 1977.

Although IC's will continue to displace discrete transistors in many applications, the use of power transistors of less than 10 amperes collector current will continue to rise. These devices are in high demand by electrical power utilities and by manufacturers of automotive electronics systems, consumer audio equipment, TV receivers, and high-frequency communications equipment.

Resistors.—Rising use of resistors in specialized

applications is expected to boost the British resistor market from \$67 million in 1973 to around \$85 million in 1977. This 5-year forecast represents a market growth averaging approximately 6% a year.

Of greater significance to U.S. resistor suppliers, however, is import growth, which rose 81%—from \$13 million to \$23 million—between 1971 and 1973. Imports are forecast to reach more than \$30 million in 1977. Best sales potential is seen for variable and thick film resistors. Sales of variable resistors are expected to continue to grow at an average annual rate of about 10% a year through 1977. Thick film power resistor assemblies will be in increasing demand during the next 5 years, as they are expected through that period to displace the more expensive wirewound power resistors in TV receivers and a variety of other consumer products.

Other electronic components.—Among the types of electronic components outside the product category that offer promising sales opportunities to U.S. exporters are the following:

Connectors.—Based on a predicted average annual growth of more than 10%, purchases of connectors are expected to rise from \$56 million in 1973 to \$84 million in 1977. Printed circuit and coaxial connectors have the best sales potential.

British manufacturers in the computer, instrumentation, and business machine industries are currently the best markets for connectors. Manufacturers are continually searching for new applications, however, and are expected to use connectors increasingly in the nuclear energy field and in certain consumer products, including vending machines, clocks, and watches.

Thyristors.—The British market for thyristors, estimated at \$10 million in 1973, is expected to increase at an average annual rate of over 12%, reaching \$16 million in 1977. Best sales prospects are for bidirectional triacs and 7.5-35A, 1500v. unidirectional thyristors.

Sales of bidirectional triacs, particularly those used in light dimmers, are forecast to climb from 500,000 units in 1973 to about 3.5 million units in 1974. Consumption of unidirectional thyristors, used primarily for motor control and lighting inverters, is projected to increase nearly 64% between 1973 and 1974, going from 1.1 million to almost 1.8 million units.

The market for unidirectional thyristors for use in welding and heating equipment, electric vehicles, battery chargers, converters, and variable-speed drives is expected to increase over 30% between 1973 and 1974, rising from 120,000 to 160,000 units. Sales of unidirectional thyristors for motor control and electric traction will almost double between 1973 and 1974, advancing from 2,400 to 4,600 units.

Special semiconductor devices.—Rising demand is forecast for light emitting devices due to growth in production of hand-held calculators, automotive dashboard displays, and instrumentation displays. Sales of these devices, estimated at about \$8 million in 1973, are forecast to reach \$30 million in 1977. The market for photosensors, which was estimated at \$3 million in 1973, is expected to increase at a 20% average annual rate during the next 5 years. Rapidly rising British demand for Gunn-effect diodes, particularly for use in microwave applications and security alarm systems, is expected to result by 1977 in a doubling of the present \$2.5-million annual market.

Selected End-User Industries

The industrial/commercial equipment sector of the British electronics industry is the best market for electronic components, accounting for an estimated 52% of the country's total purchases. The consumer products sector is the second largest user of components, accounting for roughly 39% of the total market. Trade sources predict that by 1977 each of these two major user sectors will account

Table 2.—United Kingdom: Imports from the United States, and U.S. share of total imports, of selected groups of electronic components, 1969-72¹

(in millions of U.S. dollars)

Description	1969		1971		1972	
	Value	U.S. share (percent)	Value	U.S. share (percent)	Value	U.S. share (percent)
Resistors	5.9	52	3.1	24	3.9	19
Capacitors	4.5	28	4.1	19	4.0	15
Color TV picture tubes	2.3	42	3.0	12	9.6	20
Diodes and rectifiers	5.8	53	4.5	35	8.7	46
Transistors	10.0	47	10.8	39	5.5	19
Integrated circuits	10.4	68	7.9	39	9.2	36
Total	38.8	48	33.5	28	40.9	24

¹ Parts and accessories not included.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

for about 45% of Britain's total components consumption. The military equipment sector's present 9% share of component consumption is expected to remain stable through 1977. Since industry figures show no breakdown of expenditures for components by the industrial/commercial and military sectors, the two are treated together in the following section.

Industrial/commercial/military equipment sector.—British production in 1972 of telecommunications equipment, computers and related equipment, communications equipment, industrial electronic control equipment, measuring and test instruments, medical electronic equipment, automotive electronic systems (except automobile radios and tape players), and other industrial electronic end-products totaled about \$2.1 billion. Production is expected to increase at an average annual rate of 11% during the 1973-77 period, reaching nearly \$4 billion in the latter year. The sector employed an estimated 246,000 persons in 1971.

Telecommunications equipment.—The telecommunications equipment industry, the largest single subsector in the industrial/commercial/military electronics equipment sector, accounted for nearly 35% (\$735 million) of the sector's output in 1972. Telephone exchange equipment accounted for 60% (\$440 million) of this output; data transmission equipment, 16.5% (\$122 million); subscriber apparatus, 13% (\$96 million); and switching and other telecommunications equipment, 10.5% (\$77 million).

The British Post Office Corporation (POC), by far the telecommunications industry's largest customer, purchased 68% of the industry's total output in 1971. Its planned expenditures for expansion and modernization of the nation's telecommunications system during the period 1973-77 are placed at \$5 billion. The expected rapid rise in telecommunications industry sales to the POC and the optimistic outlook for expanded export sales underlie a 1977 production forecast of over \$1.3 billion, a gain of more than 80% over 1972 output.

The leading manufacturers of telecommunications equipment are the General Electric Company (GEC), the Plessey Co., Ltd., and Standard Telephone and Cables, Ltd. (STC), an ITT subsidiary. STC supplies about 25% of the POC's requirements.

Computers and related equipment.—Production in the computer industry reached \$511 million in 1972, representing approximately 24% of the industrial/commercial/military electronic equipment sector's total output in that year. Production of computer hardware in 1973 was an estimated \$615 million. It is forecast to rise at an average annual rate of nearly 12% over the 1973-77 period, reaching \$965 million in the latter year. Production of related

equipment, including electronic calculators, electronic typewriters and electronic cash registers, is expected to reach \$50 million in 1977.

British-owned companies account for more than 40% of the computer industry's annual production. The largest of these is International Computers Ltd. (ICL). ICL is expected to announce a new range of models designed to expand both domestic and export sales. To help launch the new line, the Government provided ICL with \$35 million and has agreed to contribute an additional \$65 million for R&D up to 1976. The Government, moreover, has adopted a "buy-British" program which will help the firm further expand its share of the British computer market. Trade estimates put ICL production growth at around 15% a year through 1977.

Other British computer manufacturers include: Ferranti, Ltd.; GEC Computers, Ltd.; and Computer Technology, Ltd. Major U.S. manufacturing subsidiaries in the United Kingdom include: IBM; Honeywell Information Systems, Ltd.; NCR Co., Ltd.; Burroughs Machines, Ltd.; Mohawk Data Systems; Univac; and Digital Equipment Corporation. These U.S. firms account for almost 60% of the computer industry's 1972 production.

ICL has no electronic components production capability at present and gives no preferential treatment to firms with an ownership share in the company. It does assemble semiconductor memories from purchased circuits. The computer divisions of Ferranti and other British computer manufacturers buy on the open market and give little or no preference to their affiliated component producers.

American subsidiaries manufacturing in the United Kingdom supply 55 to 60% of the computer industry's requirements for electronic components. IBM produces some semiconductors in Europe for use in its British operations and is expected to expand component production in the United Kingdom to meet its own needs. NCR and Burroughs are expected to establish semiconductor production capability in Europe to supply their British plants. Honeywell produces electronic components in the United Kingdom on a small scale.

Communications equipment.—The communications equipment industry, including manufacturers of radar, navigational aids, and radio communication and public broadcasting equipment, accounted for 20% (\$440 million) of the sector's total production in 1972. Purchases by the military accounted for 40 to 45% of the industry's total output. The military share is predicted to remain relatively stable at around 40% during the period 1974-77. Manufacturing subsidiaries and licensees of American firms in Britain account for an estimated 15 to 20% of the communications industry's total component purchases.

Electronic instrumentation and industrial control equipment.—Electronic process control systems are being used increasingly (1) in a wide variety of manufacturing processes, (2) for handling and storage systems, and (3) to monitor pollution and other environmental factors. Production, representing about 9% of total sector output, is expected to rise from \$182 million in 1972 to \$350 million in 1977.

British production of instrumentation equipment, including measuring and test equipment, nucleonic instruments, and medical electronic and X-ray equipment, was valued in 1972 at \$150 million, or about 7% of total sector output. Production of measuring and test instruments accounted for 75% of the industry's production.

Medical electronic equipment.—The production of medical electronic equipment and instruments was \$18 million in 1972. According to industry sources, however, not all electronic equipment used for medical purposes is included, and the figure should actually be two or three times greater. The market is forecast to expand rapidly in the mid-1970's, due to past underinvestment in electro-medical equipment. Production of medical electronics is therefore expected to grow at an average rate of 15% a year during the 1974-77 period, rising to between \$75 and \$100 million in 1977.

The presence of several large manufacturing subsidiaries and licensees of American firms in this industrial subsector brings the share of electronic components purchases accounted for by American affiliates to 20 to 25%.

Consumer products sector.—British production of consumer electronic products totaled \$1.6 billion in 1972 and is forecast to rise 150% to about \$4 billion in 1977. The radio and television broadcast receiving and sound reproduction equipment subsector makes, by far, the largest single contribution to the sector's output. Production was \$707 million in 1972, or approximately 40% of the consumer product sector's total output. This figure is forecast to more than double to \$1.5 billion in 1977.

Television receivers.—The United Kingdom boasts Europe's fastest growing color TV receiver market. In worldwide production, the British industry ranks third behind Japan and the United States. Output of both black-and-white and color models rose 25%, from 2.4 million units in 1971 to 3 million units in 1973. Production of color sets alone rose 130%, from 834,000 units in 1971 to almost 2 million in 1973. Although demand for color televisions is peaking, production should continue to account for the largest share by value of the consumer product sector's output.

Thorn Colour Tubes, Ltd., Britain's leading TV set producer, supplies over one-third of the country's color TV set market. It has announced sub-

stantial expansion plans with an eye to increasing exports to Europe. Receivers manufactured specifically for export, particularly to Germany, will have features not available in models made for the home market. These include slider controls, eight-channel touch tuner with channel selector indicator, remote control option, and switched time constant on the horizontal synchronization circuits to accommodate the flutter of video tape recorders.

Other major British television manufacturers are: Rank Radio International, Ltd.; GEC Radio and Television, Ltd.; and Decca Radio and Television, Ltd. The only significant foreign producers in the industry are Pye Telecommunications, Ltd., a Philips subsidiary, and ITT Consumer Products, Ltd.

Thorn manufactures color TV picture tubes under license by RCA. Though it produces most of its own tubes, it will, when necessary, buy from outside suppliers. Pye, the nation's second largest color TV receiver manufacturer, purchases almost all of its tubes and other electronic components from Philips subsidiaries in the United Kingdom and Europe. Rank Radio reportedly will buy components from any source, provided the price is right. GEC has an "open" buying policy but does produce some specialized components for its own use. ITT is a highly integrated company producing a complete range of components but allows its subsidiaries to "shop around" for their component requirements. ITT Consumer Products and Thorn, the two U.S. affiliates manufacturing television receivers in the United Kingdom, account for 25 to 30% of component demand by the industry.

Radio and audio equipment.—The British radio manufacturing industry supplies less than 10% of home demand, and output has been declining in recent years in the face of mounting competition from the Far East. Production of car radios, however, is expected to almost double from 555,000 units in 1972 to nearly 1 million units in 1977.

Demand for tape recorders, particularly for the less expensive cassette models, has doubled every year since 1969. Imports have been the main beneficiaries of the growing market, however, and British production has remained at an annual output of around 300,000 units. Despite competition from imports, production of audio components is projected to rise. Stereo amplifier output, for instance, is expected to increase from 550,000 units in 1973 to 800,000 units in 1977.

Photographic equipment.—Production of photographic equipment in the United Kingdom totaled \$160 million in 1972 and should reach \$225 million in 1977. The product line includes photocopying equipment, cameras, projectors, and exposure meters. These are mainly in the low-cost range. The total value of electronic components used in these

products is projected to be roughly \$5 million annually by 1977.

The Competitive Environment

The British electronic components industry is strongest in the manufacture of tubes, power devices, and standard passive devices such as capacitors, resistors, and connectors. Foreign suppliers are generally considered to be more advanced in the development and production of integrated circuits and the more sophisticated semiconductor devices, such as LED's.

Domestic production of product category components rose from \$266 million in 1969 to \$442 million in 1973. It is expected that output will expand at an average rate of 10% a year and reach \$650 million in 1977. Exports, which in 1973 amounted to \$118 million, or slightly more than 20% of production, should reach almost \$206 million in 1977. This represents an average annual growth rate of 15%. British manufacturers will continue to account for approximately 60% of domestic consumption of product category components. American subsidiaries and licensees manufacturing these components in the United Kingdom supply roughly half of this market.

Color TV picture tubes.—A determined effort by British color TV picture tube manufacturers to boost both production and exports underlies average annual growth rates of 11% and 23%, respectively, that are forecast for the 1973-77 period. Production was estimated at over \$127 million in 1973 and should reach more than \$195 million in 1977. Exports are projected to more than double between 1973 and 1977, rising from \$34 million to \$76 million.

The major domestic manufacturers are Thorn Colour Tubes, Ltd., a licensee of RCA, and Mullard, Ltd., a subsidiary of Philips of the Netherlands. Thorn's output alone represents about 55% of the industry's production for home consumption. Thorn plans to expand production at its largest plant from 750,000 to 1.2 million tubes per year by mid-1975. Mullard is adding a second production line at its largest plant, increasing capacity from its current annual output of approximately 300,000 tubes to 900,000 tubes by the late 1970's.

Import figures for 1972 show Japan as the leading foreign color TV picture tube supplier, with a 28% share of the import market. The United States is Britain's second leading foreign source of supply, with a 23% share of the import market, followed by France with 19% and Canada with a 13.5% share.

Capacitors.—British production of capacitors amounted to almost \$76 million in 1973. Based on a predicted average annual growth rate of nearly

10% a year, production should reach \$108 million in 1977.

Exports, representing about 11% (\$13 million) of output in 1973, are expected to grow an average of 17% a year and reach \$24 million in 1977. With export growth outpacing production increases, the British industry's share of domestic consumption is expected to shrink from 61% in 1973 to approximately 56% in 1977.

Import figures for 1972 show Germany as the leading foreign supplier with a 21% share of the import market, followed by the Netherlands with 17%, the United States with 15%, and Japan with a 10% share.

A declining trend in imports from the United States is due primarily to the establishment of American manufacturing facilities in the United Kingdom and other European countries. Major U.S. subsidiaries manufacturing capacitors in the United Kingdom include: Dublier, Ltd.; Erie Electronics, Ltd.; ITT Components Group Europe; and Sprague Electric. Their share of British production for home consumption is estimated to be between 30 and 40%. Mullard, Ltd., and Facel (U.K.), Ltd., an Italian subsidiary, are the other major foreign-owned subsidiaries.

The principal British-owned capacitor producers are: Hunt (A.H.), Ltd; Plessey Co., Ltd.; Advance Filmcap, Ltd.; and Pye T.M.C. Components, Ltd.

Integrated circuits.—British production of integrated circuits is expected to rise from \$61 million in 1973 to over \$150 million in 1977, an average annual growth rate of 25%. Exports also are forecast to grow at a 25% average annual rate and reach \$56 million in 1977, up from \$23 million in 1973.

Six subsidiaries of U.S. firms are dominant in British IC manufacturing: General Instrument (U.K.), Ltd.; ITT Components Group Europe; Motorola Semiconductors, Ltd.; National Semiconductor (U.K.), Ltd.; Signetics International, Ltd.; and Texas Instruments, Ltd. These firms account for 70 to 80% of the country's production of IC's for domestic consumption. Texas Instruments is in the lead, followed by Motorola, General Instrument, and National Semiconductor.

Texas Instruments, the nation's largest semiconductor manufacturer, has two plants in the United Kingdom. Motorola recently opened a large factory in Scotland that will be its European center for development of MOS technology. General Instrument is regarded as the British leader in the MOS field. National Semiconductor has a small MOS wafer fabrication plant in Scotland. ITT is a major producer of TTL and MOS circuits in the United Kingdom. This firm's strong position in the industry is partly due to the fact that it supplies tele-

communications equipment circuits to its subsidiary, STC.

Other foreign subsidiaries manufacturing IC's in Britain are Mullard (Dutch) and SGS/ATES (Italian).

Ferranti, GEC, and Plessey Co. are the major nationally owned IC manufacturers. They do not have a strong position in the market, however. Government efforts to encourage development of advanced IC capability by national firms have not been totally satisfactory. The Government now plans to provide \$24 million over the next 6 years to help the three leading British producers develop more competitive products.

Approximately 50% of Britain's IC requirements are satisfied by imports. The United States was the leading foreign supplier in 1972, with a 36% share of total imports; Singapore was second, with 25% of the total, followed by Germany, with a 13% share.

Diodes and rectifiers.—Annual production of diodes and rectifiers in the United Kingdom reached nearly \$61 million in 1973. It is forecast to approach \$70 million by 1977. Exports were valued at \$9 million in 1973 and are expected to remain at the same level during the 1973-77 period.

The domestic industry is notably stronger in the production of higher power devices, for which it meets about two-thirds of home demand. The majority of imports (85 to 90%) are low-current devices, such as voltage reference and regulator diodes and other diodes and rectifiers rated at less than 0.5 amperes. The United States is the principal foreign supplier of these components to the United Kingdom; in 1972, the United States held a 46% share (\$8.7 million) of the import market. The Netherlands and Germany ranked second and third, with shares of 20% and 10%, respectively.

Major manufacturers of diodes and rectifiers in the United Kingdom include: AEI Semiconductors, Ltd.; Ferranti, Ltd.; Westinghouse Brake and Signal; and J. Lucas (Electrical), Ltd.

Motorola Semiconductors and Texas Instruments, the two largest American-owned manufacturers, together account for 35 to 40% of British output for home consumption. Other important U.S. manufacturing subsidiaries are International Rectifier Co. (Great Britain), Ltd., and ITT Components Group Europe. Mullard is the only other major foreign-owned firm manufacturing diodes and rectifiers in Britain.

Transistors.—Almost all British transistor production is of devices in the low-to-medium power range. This has opened the market to substantial imports of high-power transistors. In fact, over half of Britain's purchases of transistors in 1973 were supplied by imports, of which roughly 90% were

silicon devices. The United States is the leading foreign supplier, with a 19% share of the import market, followed by France and Singapore, each with 13%, and Belgium and Germany, each with a 10% share.

United Kingdom transistor production, totaling \$62 million in 1973, is expected to slip to less than \$60 million by 1977. Concurrently, exports are forecast to decline from \$27 million to \$23 million.

Major British transistor manufacturers are Ferranti and Westinghouse Brake and Signal. ITT Components Group Europe, Texas Instruments, and Motorola Semiconductors are the leading U.S. manufacturing subsidiaries; Mullard and SGS/ATES are the other principal foreign-owned firms in the industry. The American subsidiaries account for 45 to 50% of the British transistor production for domestic consumption.

Resistors.—Production of resistors is expected to grow moderately at an average annual rate of almost 6%, climbing from \$56 million in 1973 to \$70 million in 1977. Exports, currently representing about 20% of total production, are expected to grow at an average rate of 10% a year, raising export sales from \$12 million in 1973 to \$17 million in 1977.

The leading manufacturers in the British resistor industry are: A.B. Electronic Components, Ltd.; Ferranti, Ltd.; Penny & Giles Group; and Welwyn Electric, Ltd. Principal American subsidiaries manufacturing resistors in the United Kingdom are: Allen-Bradley U.K., Ltd.; Bourns (Trimpot), Ltd.; and Beckman Instruments, Ltd. U.S. manufacturing subsidiaries account for 50 to 60% of British resistor production for home consumption.

Imports of resistors currently account for just over one-third of total domestic sales. This proportion is expected to increase, however, due to reductions in the tariff applied to resistors imported from the European Economic Community (EEC) member countries. The U.S. share of the 1972 import market was 19%, which was second to the Netherlands' 19.4% share and ahead of Germany's 14% and Denmark's 8.5% shares.

Market considerations.—British end-users usually buy components from the supplier offering the best product at the lowest price. This policy is even followed by the equipment divisions of large companies with their own component manufacturing subsidiaries. However, some U.S. subsidiaries and licensees "buy-British" wherever possible, as a public relations gesture. Also, the specifications for equipment for many Government projects, including military programs, require that the components used must be manufactured or assembled in the United Kingdom, although not necessarily by British-owned firms.

Import duties.—Under the terms of its entry into the EEC, the United Kingdom must reduce the customs duties on electronic components imported from the nine EEC member countries by 20% each year until the duties are completely abolished by July 1, 1977. At the same time, Britain must bring the customs tariffs applicable to electronic components imported from nonmember countries, including the United States, into line with the EEC Common External Customs Tariff rates. The alignment, begun in January 1973, is to be completed by the end of 1977.

The current customs duty rates applicable to electronic components entering Britain from the United States range from 8 to 20%, based on the cost, insurance, and freight (c.i.f.) values. Information on official duty rates applicable to specific products within the product category may be obtained from the U.S. Department of Commerce, Domestic and International Business Administration, Room 4217, Main Commerce, Washington, D.C. 20230.

Both locally produced and imported electronic components are also subject to a 10% value-added tax. This is assessed on the imported product's duty-paid value.

Technical Requirements

The electrical power supply characteristics in the

United Kingdom are 240/415 volts, 50 hertz, single or 3-phase.

The metric system of weights and measures will replace the traditional "English" system by 1975. Though the old system is still prevalent in everyday life, industry is rapidly effecting the changeover.

The British Standards Institute and members of the British electronics industry have been working since 1965 on a system of common standards for electronic components for military and industrial use. Called the BS9000 system, it sets certain minimum standards of quality, reliability, and safety that components must meet. The system has gained wide acceptance in the United Kingdom. Published national standards for electronic components in the United Kingdom may be obtained through the American National Standards Institute, Inc., 1430 Broadway, New York, N.Y. 10018.

The following market research study, upon which this Country Market Survey is based, is available on loan from the U.S. Department of Commerce, Domestic and International Business Administration, Room 1617M, Main Commerce, Washington, D.C. 20230:

"The Market for Electronic Components in the United Kingdom," DIB 74-02-508, November 1973.

III. Country Market Briefs

Abbreviated surveys of five additional country markets for selected groups of electronic components are contained in this section. These *Country Market Briefs* are based on reports prepared by the commercial sections of the U.S. Embassies and Consulates in the countries surveyed.

The *Country Market Briefs* include information similar to that contained in the *Country Market Surveys* and, to the extent possible, follow the same format.



Argentina

The market for electronic components in Argentina totaled approximately \$60 million in 1972. Sales of the selected groups of components covered in this report¹ were estimated at \$14.1 million (see table 1). Purchases of these components are expected to rise at an average rate of 11.6% per year, from about \$15 million in 1973 to more than \$23 million in 1977 (see table 2).

The market for integrated circuits is expected to demonstrate the fastest growth rate—an average of over 18% annually—climbing from \$1.2 million in 1973 to almost \$2.4 million in 1977. Sales of transistors are forecast to increase at an average annual rate of 15%, rising from \$3.7 million to more than \$6.5 million during the same period. The markets for resistors and capacitors are each projected to increase at an annual rate of about 9.5% through 1977.

U.S. exports of product category components to Argentina in 1972 totaled \$849,000 (see table 3).

Sales Opportunities

Knowledgeable industry sources indicate that good sales potential exists in Argentina for the following U.S.-made electronic components:

Capacitors

- Fixed electrolytic
- Fixed ceramic
- Variable

Transistors

- General purpose silicon, small signal and power
- Switching silicon, small signal and power
- Special purpose silicon, small signal and power

Resistors

- Fixed composition
- Fixed wirewound
- Variable

Diodes and Rectifiers

- Silicon diodes
- Silicon zener diodes
- Diode arrays
- Power rectifiers

Integrated circuits

- Linear

¹ Electronic components covered in this report are basically confined to resistors, capacitors, color TV picture tubes, diodes and rectifiers, transistors, and integrated circuits. The term "product category" as used in this publication is limited to these six groups of components.

Other electronic components

- Cathode ray picture tubes
- Cathode ray industrial and special purpose tubes
- Silicon controlled rectifiers
- Electromagnetic relays

Table 1.—Argentina: Size of market¹ for selected groups of electronic components, 1972

	(in thousands of U.S. dollars)			Market Size
	Production	Imports	Exports	
Resistors	650 ²	1,685	46	2,289
Capacitors	3,500	2,959	499	5,960
Color TV picture tubes .	—	—	—	—
Diodes and rectifiers ..	200	1,300	140	1,360
Transistors	2,300	1,600	472	3,428
Integrated circuits	—	N.A.	N.A.	1,100
TOTAL	6,650			14,137

¹ Size of market equals production plus imports minus exports. Parts and accessories not included.

² Production figures include a small amount (no more than 10%) of resistors manufactured by OEMs, for their own use.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

Table 2.—Argentina: Size of market for selected groups of electronic components,¹ 1972-73 and projected 1975 and 1977

	(in thousands of U.S. dollars)			
Description	1972	1973	1975	1977
Resistors	2,289	2,340	2,690	3,360
Capacitors	5,960	6,240	7,180	8,970
Color TV picture tubes .	—	—	—	—
Diodes and rectifiers	1,360	1,400	1,540	1,930
Transistors	3,428	3,740	4,680	6,550
Integrated circuits	1,100	1,210	1,570	2,360
TOTAL	14,137	14,930	17,660	23,170

¹ Parts and accessories not included.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

Table 3.—U.S. exports to Argentina of selected groups of electronic components,¹ 1972

(in thousands of U.S. dollars)	
Description	
Resistors	54
Capacitors	191
Color TV picture tubes	—
Diodes and rectifiers	153
Transistors	172
Integrated circuits	279
Total	849

¹ Parts and accessories not included.

Source: U.S. Exports, Commodity by Country, FT-410, December, 1972, U.S. Bureau of the Census.

Because Argentina's production meets all or most of the demand for a number of basic electronic components required by domestic consumer products manufacturers, and because Argentina accords component manufacturers in Brazil and Mexico preferential tariff treatment, U.S. suppliers will find it more profitable to concentrate their efforts on selling high technology components in this market. The two component groups considered to offer the most promising sales opportunities to American suppliers are integrated circuits and transistors.

Selected End-User Industries

The consumer products sector, with 1972 sales of approximately \$150 million, is the largest and fastest growing sector in Argentina's electronics industry. The radio and television industry is the best market for electronic components within the consumer products sector. The only other important subsector is the audio equipment industry. There are no pocket calculators or electronic watches made in Argentina at present. The production of electronic photographic equipment is insignificant.

The consumer products sector includes 110 to 120 firms that together employ roughly 7,000 persons. In addition, an indeterminate number of workers assemble products in "garage-type" operations. Output in 1972 comprised 900,000 transistor radios, 380,000 black and white TV sets, 260,000 record players, 208,000 automobile radios, 143,000 tape recorders, 113,000 home radios, 110,000 modular hi-fi's, and 100,000 consoles.

Growth prospects for the consumer products sector during the next several years are fairly good. Industry sources predict a 5 to 7% growth in 1974 and are optimistic that this rate of growth can be maintained or exceeded through 1977.

One of the most interesting and most important facts about the production of radios and televisions in Argentina is that so many of the units produced are assembled on a cottage industry basis. Some trade sources estimate that "moonlighters" and "one-room operations" account for as much as 20% of all television sets produced in Argentina. The industry also has many small and medium-size producers and a few large ones. According to a 1970 directory of the electronics and communications industry, there were 94 companies producing television sets. Most of these firms also produce home and/or car radios. A list of the leading television receiver manufacturers, with an indication of their ownership and their respective shares of total production, is presented in table 4.

Nearly 50% of the television sets produced in 1972 were partially transistorized; relatively few were fully transistorized. However, there is a strong move by all major producers to incorporate tran-

Table 4.—Argentina: Market shares of total production of TV sets by major manufacturers, 1972

Firm	Ownership	Share of total production (percent)
Philips Argentina S.A.	Dutch	9.2
Philco Argentina S.A.	U.S.	6.5
Noblex Argentina S.A.C.E.I. ...	National	5.2
Televa S.A.I.C.I.F.	National (Licensee of CBS)	4.7
Boris Garfunkel e Hijos S.A. ...	National (Licensee of Motorola)	3.9
Tel-Rad S.A.	National (Licensee of Stromberg-Carlson)	3.9
Telesud S.A.	National (Licensee of Zenith)	2.9

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

sistors in their designs. In addition, it appears that local producers will soon begin using integrated circuits in television receiver circuitry in significant amounts. The great majority of radios produced in Argentina are transistorized.

Competitive Environment

There are 50 to 60 electronic component manufacturers in Argentina, with a total labor force of between 2,200 and 2,400 persons. A considerable number of these are very small companies that are marginally solvent. About 20 major producers account for at least 80% of the value of all electronic components manufactured in Argentina.

Although a wide range of electronic components are produced in Argentina, the types manufactured in sufficient quantity to meet the domestic needs are limited. These items include black-and-white TV picture tubes, yokes, volume controls, tuners, fixed polyester and film capacitors, ceramic "plate" capacitors, coils, transformers (including flyback transformers), printed circuit boards, connectors, mechanical switches, and certain types of receiving tubes. Production of these components is tailored to the needs of local consumer products manufacturers.

The only active components presently produced in large quantities are transistors. They are assembled locally from imported materials. However, several manufacturers plan to begin production during 1974 of MOS digital and linear integrated circuits, power transistors, Darlington amplifiers, silicon controlled rectifiers, and bi-directional triodes. The production process, like that for most other components, will largely consist of the assembly of imported parts and materials.

One of the more striking illustrations of the

dependence on imported materials occurs in the production of cathode ray picture tubes. All the glass envelopes are imported from Brazil. The electron guns are purchased from Brazil, the United States, or Holland, depending on the manufacturer.

By far the largest number of component manufacturers are of local ownership, but many of these make their products under license from foreign firms. Domestically owned firms account for about 50% of the value of component production. However, the largest and most efficient firms, with one or two exceptions, are foreign subsidiaries. The large foreign-owned firms are also the most successful in the exporting field.

Exports of electronic components have not been significant. Now the Government is providing attractive export incentives that should lead to an expansion in overseas sales. The firms that use advanced technology and have modern production equipment that can produce large runs of a standardized product are expected to benefit under the program.

U.S. suppliers of electronic components are at a disadvantage because of the special agreements which have been negotiated under the LAFTA (Latin America Free Trade Association) umbrella. Under these agreements, Argentina and other LAFTA members¹, most importantly Brazil and Mexico, have eliminated or greatly reduced their

duties on imports of many electronic components from the other signatories to the agreements.

Consequently, the greatest sales potential for U.S. exporters exists for sophisticated components not produced on a large scale in Argentina, Brazil or Mexico. A rapid rate of expansion from its current small base is anticipated for the advanced componentry market during the next 5 years. U.S. manufacturers, as the forerunners in the electronic components field, can reap the benefits of their competitive edge in this growth market.

**Argentina—Selected Indicators
(1972)**

Gross domestic product:	\$23.5 billion
Population:	23,950,000
Total country imports:	\$1.9 billion
Imports from U.S.	
(w/share of total):	\$0.4 billion (21.1%)
Total country exports:	\$1.9 billion
Exports to U.S.	
(w/share of total):	\$0.2 billion (10.5%)
Exchange rate (May 1974):	9.80 pesos=US\$1

¹ LAFTA members are Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico, Paraguay, Peru, Uruguay and Venezuela.

India

The total market for electronic components in India is expected to rise at an average annual rate of 28%, from \$105 million in Indian fiscal year (IFY) ¹ 1975 to \$220 million in 1978. This growth will be generated by government-encouraged expansion of the domestic electronics industry, particularly in the fields of telecommunications and data processing.

Sales of the selected groups of electronic components covered in this report ² totaled \$21.1 million in 1972 (see table 1). The market for these products is forecast to grow at a much higher rate than that of the market for all electronic components. Projections indicate an average increase of 41% per year during the 1975-78 period, with sales rising from about \$32 million to over \$90 million (see table 2).

Imports of electronic components within the product category totaled \$5.6 million in 1972. Nearly one-third of these imports, or \$1.7 million worth, came from the United States (see table 3).

Table 1.—India: Size of market ¹ for selected groups of electronic components, 1972
(in thousands of U.S. dollars)

Description	Production ²	Imports	Exports	Market Size
Resistors	1,480	1,500	23	2,957
Capacitors	5,020	1,680	5	6,695
Color TV picture tubes	—	—	—	—
Transistors, Diodes and Rectifiers	8,933	2,060	405	10,588
Integrated circuits	536	350	—	886
Total	15,969	5,590	433	21,126

¹ Size of market equals production plus imports minus exports. Parts and accessories not included.

² Production figures include components manufactured by OEMs, for their use.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

Sales Opportunities

A market survey recently conducted in India for the U.S. Department of Commerce, Office of International Marketing, reveals that favorable sales opportunities exist for American exporters of the following electronic components:

¹ Indian fiscal year is from April 1 through March 31. All figures, except those for 1972, are based on IFY. Figures for 1972 are based on the calendar year.

² Electronic components covered in this report are basically confined to resistors, capacitors, color TV picture tubes, diodes and rectifiers, transistors, and integrated circuits. The term "product category" as used in this publication is limited to these six groups of components.

Table 2.—India: Size of market for selected groups of electronic components,¹ 1975-78

Description	(in thousands of U.S. dollars)			
	1975	1976	1977	1978
Resistors	6,000	7,600	11,300	16,000
Capacitors	7,800	9,350	14,500	21,000
Color TV picture tubes	—	—	—	—
Transistors, Diodes and Rectifiers	15,500	19,500	29,000	40,750
Integrated circuits	2,800	4,480	7,500	12,610
Total	32,100	40,930	62,300	90,360

¹ Parts and accessories not included.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

Table 3.—India: Imports from the United States, and U.S. share of total imports, of selected groups of electronic components,¹ 1972

(quantity in thousands of units and value in thousands of U.S. dollars)

Description	Quantity	Value	U.S. share (percent)
Resistors	2,662	206	13.7
Capacitors	1,801	465	27.7
Color TV picture tubes	—	—	—
Diodes and rectifiers	110	275	49.1
Transistors	366	524	34.9
Integrated circuits	185	277	79.1
Total	5,124	1,747	31.3

¹ Parts and accessories not included.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

Transistors, diodes and rectifiers.—Indian imports of transistors in 1972 totaled \$1.5 million; imports of diodes and rectifiers amounted to \$560,000. American firms presently supply about 35% of the transistor imports and 50% of imports of diodes and rectifiers.

The total market for these components is expected to rise from about \$15 million in 1975 to over \$40 million in 1978, an average annual increase of 38%. Products offering the highest sales potential to U.S. exporters include:

- Low power silicon transistors
- High power silicon transistors
- Varicap diodes
- Silicon zener diodes

The market for transistors is expanding rapidly. While local production meets the requirements of the consumer electronic products manufacturers, a

large gap exists between local demand and supply of advanced transistors for industrial and defense applications. This gap is expected to widen further in the years ahead.

Most of the requirements for discrete diodes and rectifier and switching diodes are met by local suppliers. Domestic production of zener diodes does not meet the total demand and imports are necessary. The demand for varicap diodes, which is filled almost entirely by imports, is fairly high and is increasing.

Capacitors.—The market for capacitors in India is expected to increase at an average yearly rate of almost 40%, from \$8 million in 1975 to over \$20 million in 1978. U.S. manufacturers supplied 27.7% of the \$1.7-million import market in 1972.

Variable and ceramic capacitors offer the highest sales potential in this segment of the market. Demand for miniature ceramic capacitors is increasing rapidly, and is expected to continue outpacing the production capacity of local suppliers for several years to come.

Resistors.—Sales of resistors in 1972 totaled \$3 million, with imports accounting for roughly 50% of the total. The market is expected to rise to \$16 million in 1978, an increase of more than 180% from a projected \$6-million level in 1975.

Integrated circuits.—The market for IC's approached \$900,000 in 1972, and imports totaled \$350,000. American manufacturers currently supply about 80% of India's IC imports.

Sales of IC's should demonstrate the fastest growth of all electronic components. Based on a predicted average annual growth rate of 65%, the IC market is expected to surge from \$2.8 million in 1975 to well over \$12 million in 1978.

In an effort to produce higher quality and more competitive products, India's electronic end product manufacturers are turning increasingly to the use of IC's. However, the variety of domestically produced IC's is very limited, and those types available from local suppliers are generally based on chips diffused abroad. Local manufacturers obviously do not have the production capability or range of products required to meet OEM needs for IC's. Imports therefore are expected to account for the bulk of the Indian market for IC's in the next 5 years. Linear and digital IC's will be in greatest demand.

Other electronic components.—Electronic components outside the product category expected to have high sales potential during the next 5 years include:

- Electron tubes
- Black-and-white TV picture tubes
- Thyristors
- Printed circuit connectors
- Microwave connectors
- Mercury wetted and dry reed electromagnetic relays

Selected End-User Industries

India has a planned economy. Growth of industrial activity is carefully monitored and controlled by various government agencies to ensure that industrial investment has a maximum impact on the country's social and economic development. In keeping with this policy, more resources have been channeled toward the capital goods industries than the consumer goods sector.

Development of the electronics industry has received special governmental attention in recent years. There is a section (Department of Electronics) within the Government that regulates and promotes the growth of the electronics industry. The government has also instituted an Electronics Commission, headquartered in Bombay, which is responsible for charting the course of India's progress in electronics.

It is quite clear, from the activities of these regulatory and advisory bodies, that government emphasis will be in the development of the industrial and not the consumer electronic products sector. The consumer products sector today is still the largest segment of the electronics industry, but current trends indicate that this position is going to change radically in the next few years.

The projected annual production of India's three major electronic components user sectors are shown below, in millions of U.S. dollars.

Sector	1975	1976	1977
Consumer products	117	132	157
Industrial/commercial equipment ..	142	193	263
Military equipment	93	115	152
Total	352	440	572

The government plans an investment of approximately \$570 million in the electronics industry during the Fifth Plan period (1974-79) in order to reduce dependence on imported equipment and components. A breakdown of these planned expenditures and the estimated value of required imports of equipment and components for each sector of the electronics industry is presented below, in millions of U.S. dollars.

Sector	Investment	Imported equipment/ components needed
Consumer products	20	6
Industrial/commercial equipment	450	200
Military equipment	100	45
Total	570	251

In order to boost the growth of the electronics industry, the government-organized Trade Development Authority has, with the help of the Electronic Commission, begun work on a project for the establishment of a duty-free export processing zone to be devoted exclusively to the development of exports of electronic equipment and components. Current plans aim for an export target of \$100 million annually over the next four years.

Industrial/Commercial Equipment Sector.—The primary product areas within this sector where substantial growth in expected are telecommunications equipment, computers, and industrial controls.

Telecommunications equipment.—The telecommunications equipment industry is a rapidly growing market for electronic components. Total industry output is expected to rise at an average annual rate of 17% between 1975 and 1979. Indian trade sources forecast that the industry's annual output will surge from \$105 million to \$300 million during this period.

The Indian telecommunications system is controlled by the Government's Posts, Telephone, and Telegraph (PTT) authority. India had only 86,000 telephones in 1947 compared to 1,400,000 in 1973. The PTT has undertaken an ambitious program of expansion of telecommunications facilities. Most of the towns and cities in India are expected to be connected by coaxial cable links by the end of the Fifth Plan (1974-79) period. The hilly terrain of Jammu and Kashmir and the North Eastern region have already been connected with the rest of the country by microwave radio links. Many more microwave link projects are either underway or will be undertaken in the next five years.

The major suppliers of equipment to the PTT are Indian Telephone Industries Limited (ITI), Bangalore; Hindustan Teleprinters Limited (HTL), Madras; and Hindustan Cables Limited (HCL), Roop Narianpur.

ITI's main divisions include the Strowger Division, which in 1973 produced 128,000 exchange lines and 265,000 telephone instruments; the Crossbar Division, which manufactured 94,000 lines valued at \$15 million in 1973; and the Transmission Division, with 1973 production valued at \$12 million. These three divisions are located in Bangalore. ITI's components factory in Srinagar produced telephone parts valued at \$240,000 in 1973, and output of the firm's transmission equipment factory at Vaini totaled \$2.5 million. A telephone instruments factory at Naini is expected to go into production shortly.

HTL is engaged primarily in the development of teleprinters and ancillary equipment. This company in 1973 produced 6,042 teleprinters representing a 26.4% increase over the 1972 production of 4,779 units.

HCL produced 440,000 Km of dry core cables and 1,176 Km of coaxial cables in 1972.

ITI, HCL, and HTL plan to expand and diversify their production programs during the next 5 years. ITI expects to increase telephone production by 100,000 sets per year—from a level of 350,000 in 1975 to 750,000 in 1979. The company also plans to raise output of the Strowger Division from 175,000 lines in 1975 to 200,000 in 1978, and that of the Crossbar Division from 150,000 lines to

330,000 during that period.

HCL plans to begin production of plastic cables and copper coated sheet wire in 1974. Output of the cables will amount to 88,000 Km per year through 1978, and that of the sheet wire will rise from 1,000 metric tons in 1974 to 2,600 tons in 1975. Production of coaxial cables will increase to 3,700 Km in 1974, and dry core cable output will climb from 1.3 million Km in 1974 to 2.3 million Km in 1978.

HTL plans to make a capital investment of \$4 million during the 1974-79 period. The firm expects to introduce new models of electronic typewriters of its own design, incorporating such features as memory, greater distortion margin and higher speed. Several varieties of ancillary equipment, eight-level machines for data handling, and a variety of peripheral equipment required for computers will be manufactured. HTL also plans to enter into new fields, including electronic private branch exchanges and data modems.

None of the three major telecommunications equipment producers (ITL, HCL and HTL) has in-house capability for development and manufacture of electronic components. However, Bharat Electronics Limited (BEL), in Bangalore, designs and produces electronic components tailored to the needs of the local telecommunications equipment manufacturers.

The government has made a free foreign exchange allocation of \$7 million for imported broadcasting and telecommunications equipment during 1974. In addition, a project loan of \$80 million from the IDA (IBRD's soft lending agency) was made available for expansion of telecommunications facilities in India during the same period.

Computers and related equipment.—The growth of computer application in India, though slow at first, is picking up rapidly. The first computer was installed in India about 20 years ago. The country's computer population totaled 184 as of June 1972 and, with few exceptions, these were of foreign origin, IBM accounts for 75% of the installations; ICL (England), 13.5%; and Honeywell, 5.5%. The remaining machines were supplied by Control Data Corporation, Hewlett-Packard, Digital Equipment Corporation, and Russia's Minsk.

There is considerable interest in development of a domestic computer manufacturing capability. The Electronics Corporation of India Limited, Hyderabad, a public sector establishment, has now embarked upon the manufacture of medium-size computers (TDC-12, TDC-16 and TDC-32). The Electronics Commission has recommended that minicomputers be manufactured in the private sector, and two applications for licenses already have been submitted to the Government. The minicomputer manufacturers will require a substantial amount of imported components such as MOS/LSI's,

Electronics Manufacturers' Profiles

The two largest producers of electronic end products and components in India are Bharat Electronics Ltd. and Electronics Corporation of India Ltd.

Bharat Electronics Ltd. (BEL), located in Bangalore, manufactures 40 different types of electronic equipment, including sophisticated and specialized transceivers, transmitters and radars. Components produced by this firm include capacitors, electron tubes, semiconductor devices, transistors, connectors and crystals. The gross value of production showed a tenfold rise during the 10-year period ended March 31, 1971.

BEL has a well equipped research and development organization. It has developed 14 types of receiving tubes, five types of cathode ray tubes, one type of X-ray tube, and five types of transmitting tubes. The company has manufactured storm warning radars, and a cyclone warning radar is expected to be ready for installation in 1974. Among many new items being developed are a complete range of HF, VHF and UHF communications equipment.

The company has placed orders for plant and machinery for the production of TV picture tubes under license arrangements with Nippon Electric Company, Japan. It recently commenced manufacture of integrated circuits in collaboration with Radio Corporation of America.

BEL plans to begin manufacturing TV transmission and studio equipment in collaboration with Nippon Electric Company, and with Fernsch of Germany. It also proposes to manufacture 30,000 TV receivers a year.

Another new project to be taken up by BEL is the production of a desk calculator which has been developed in collaboration with the Jadavpur University.

The company's new \$15-million plant facility at Ghaziabad in Uttar Pradesh commenced production of surveillance radars and microwave communications equipment in December 1973.

Electronics Corporation of India Ltd. (ECIL), in Cherlapali, produces a wide range of sophisticated electronic equipment. ECIL's total production rose 62% between 1970 and 1971, to \$2.7 million. In 1968, the first year of production, the value of finished output was \$200,000. The company's manufacturing activities are mainly spread over eight divisions, namely the Nuclear and Allied Instrumentation Division, Resistors and Capacitors Division, Semi-conductors Division, Power Reactor Instrumentation Division, Servo Controls Division, Computer Division, Microwave Division, and Special Products Division.

The Nuclear and Allied Instrumentation Division has established itself as India's premier source of modern transistorized modular nuclear instrumenta-

tion, high performance oscilloscopes, closed-circuit television equipment, and medical electronic equipment. The division produced goods worth \$1.2 million in 1971.

The products turned out by the Resistors and Capacitors Division and Semi-conductors Division include electronic components such as carbon and metal film resistors, solid tantalum capacitors, variable wirewound resistors, zener diodes, germanium power transistors, and thermoelectric cooling modules. The production of goods from these divisions in 1971 was valued at \$300,000.

The Servo Controls Division, which has concentrated its main effort on the development and production of India's first small AC gear motor, the AC510, went into commercial production during the final quarter of 1971. The production from the division was valued at \$100,000, which included the value of X-Y plotters supplied to the Power Reactor Instrumentation Division.

The Power Reactor Instrumentation Division made substantial progress during 1970 and 1971. This division manufactured and supplied to the Rajasthan Atomic Power Project site the solid-state logic and control equipment for the fuel handling mechanisms. Value of work completed at this division during 1971 was \$600,000. ECIL continues to receive orders for providing instrumentation and control systems for new nuclear power stations and allied plants being set up in various parts of the country.

The Computer Division of the company distinguished itself in 1971 by producing India's first on-line digital computer, as well as by supplying a variety of software facilities to enable users to effectively utilize such computers. The division turned out products worth \$200,000 in 1971.

The activities of the Microwave Division during 1971 were concentrated on the development and engineering of various microwave test instruments and components for commercial production.

A new division known as "Special Products Division" was established in 1971 for the manufacture on a commercial scale of a sophisticated product for defense requirements.

The company's new Television Division has just started manufacturing commercial television sets. The production activity includes manufacture of only a few critical components besides assembly and testing. Most of the remaining components and sub-assemblies are secured from the other divisions of ECIL.

ECIL has formulated and submitted to the government a 5-year expansion program under which the cumulative capital investment by the end of 1976 would reach \$15.3 million, with an employment potential of 5,200 workers. A sales target of \$30 million is expected to be achieved in 1976. The expansion program has been approved by the

Atomic Energy Commission, the Electronics Commission, and the Planning Commission. A significant feature of the expansion plan is the role played by the corporation in the development and manufacture of small and medium-size computers. The company hopes to produce over \$6.7 million worth of computers in 1976.

The Competitive Environment

The components sector of the Indian electronics industry is presently growing at a slower rate than the equipment sectors, although planners recognize the need to base their production of electronic products on a well developed system of domestic components manufacture.

Production of electronic components in India increased from \$660,000 in 1960 to about \$36 million in 1972 (see table 4), and it is expected to reach a yearly level of \$175 million by 1979. Knowledgeable government and industry sources estimate that about 80% of the components for the consumer electronics sector are supplied by local industry. However, production of high performance type components for industrial applications has grown slowly, and the gap between demand and local supply is, in fact, increasing.

India's total 1972 exports of components within the product category amounted to \$432,500.

There are approximately 45 major manufacturers of electronic components in India. Among the important locally owned firms, with the types of components they manufacture shown in parentheses, are R. V. Mehta & Sons, Calcutta (resistors); National Electronics Pub. Ltd., Baroda (resistors); Atlas Radio and Electronic Industries Pub. Ltd., New Delhi (capacitors); Bolton Industrial Corporation, New Delhi (capacitors); Uranus Electrotechnik Pub. Ltd., Bombay (capacitors); Hindustan Conductors Pub. Ltd., Bombay (diodes, transistors, integrated circuits); and Usha Rectifier Corporation (India) Limited, Haryana (rectifiers).

Most of the concerns manufacturing electronic components in India rely heavily on imported "know-how" and capital. A majority of them have licensing agreements with foreign companies.

Approximately a dozen American electronic component manufacturers have financial and technical agreements with Indian firms. Industry sources indicate that manufacturing licensees of U.S. firms share about 30% of the domestic market.

Major U.S. suppliers of electronic components to India include RCA and General Electric (electron tubes); International Rectifier, Westinghouse and Motorola (thyristors); Texas Instruments, National Semiconductors, Fairchild Camera and Instruments, American Micro Systems, Intel, and Arrow International (integrated circuits); and Hewlett-Packard, Litronix, Monsanto, Unipage International, and Motorola (special semiconductor devices).

Table 4.—India: Production of electronic components, 1972

Component	(quantity in single units and value in thousands of U.S. dollars)	
	Quantity	Value
Electron tubes		
Receiving	5,020,000	3,000
Transmitting	11,800	1,000
TV picture	27,000	1,420
Cathode ray	1,085,000	40
Microwave	120	170
X-ray	1,186	590
Semiconductor devices		
Transistors, diodes and rectifiers	38,000,000	8,933
Integrated circuits	200,000	536
Fixed resistors		
Carbon film	67,500,000	650
Variable resistors	4,500,000	830
Fixed capacitors		
Paper	4,700,000	280
Ceramic	38,300,000	800
Plastic film	24,000,000	1,330
Electrolytic	10,000,000	1,080
Mica/silver mica	1,400,000	200
Variable capacitors	2,300,000	1,330
Connectors, relays and switches ..	—	4,530
Crystals	220,000	1,520
Transformers, chokes and coils ..	—	8,000
TOTAL		36,239

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

Other important foreign suppliers include Philips of Holland; BTM-ITT, Belgium; CSF Thompson, France; Mullard, Plessey, and Redifon, United Kingdom; Nippon Electric and Fujitsu, Japan; and Siemens, Germany.

Import duties.—India levies an import duty of 40% ad valorem on electronic components and 65% on electronic end products.

All imports into India are regulated, and licenses are issued depending on the availability of foreign exchange. Preference in granting import licenses is given to rupee payment sources and to countries which provide bilateral aid credits.

India—Selected Indicators

(IFY¹ 1973)

Gross national product:	\$63.6 billion
Population (1971):	563 million
Total country imports:	\$2.4 billion
Imports from U.S.	
(w/share of total):	\$298 million (12.4%)
Total country exports:	\$2.6 billion
Exports to U.S.	
(w/share of total):	\$363 million (14.0%)
Exchange rate (May 1974):	7.60 rupees=US\$1

¹ Indian fiscal year: April-March.

Korea

Continued rapid growth in Korea's production of electronic end-products is expected to boost the country's total market for electronic components and parts an average of over 35% annually during the next 4 years. Based on this forecast, annual sales of components and parts in 1977 should approach \$610 million, up from \$175.2 million in 1973 and \$103.9 million in 1972 (see table 1).

Korea's imports of electronic components and parts rose 55% from 1972 (\$80 million) to 1973 (\$124.4 million). Imports, growing at an average annual rate of about 30% from the 1973 level, are expected to exceed \$345 million in 1977.

The 1972 market for the selected groups of electronic components covered in this report¹ totaled \$24.7 million (see table 2). Sales of these components are forecast to increase threefold during the 1973-77 period, exceeding \$75 million in the latter year.

Imports, valued at \$12.1 million, accounted for 49% of Korea's 1972 market for product category

components. If industry predictions hold, imports of such components should approach the \$40-million level in 1977.

Korean purchases of U.S.-made product category components in 1972 amounted to \$4.6 million, or 38% of the import market (see table 3). Imports from the United States, spurred by the Korean electronics industry's increasing needs for advanced components, are expected to triple to \$15 million in 1977.

Table 3.—Korea: Imports from the United States, and U.S. share of total imports, of selected groups of electronic components, 1972¹

Description	Value	U.S. share
		(percent)
Resistors	71	5
Capacitors	49	3
Diodes and rectifiers	123	16
Transistors	151	7
Integrated circuits	4,175	72
Total	4,569	38

¹ Parts and accessories not included.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

Table 1.—Korea: Size of market¹ for electronic components, 1972-77.

Description	1972	1973	1977
Production	127.1	229.0	695.8
Imports	80.0	124.4	346.4
Exports	103.2	178.2	433.9
Market size	103.9	175.2	608.3

¹ Size of market equals production plus imports minus exports. Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

Table 2.—Korea: Size of market¹ for selected groups of electronic components, 1972 (in millions of U.S. dollars)

	Production	Imports	Exports	Market Size
Resistors	2.6	1.5	2.4	1.7
Capacitors	6.0 ²	1.7	3.9	3.8
Diodes and rectifiers .	.3	.8	.2	.9
Transistors	26.6 ²	2.3	25.8	3.1
Integrated circuits ...	48.8	5.8	39.4	15.2
Total	84.3	12.1	71.7	24.7

¹ Size of market equals production plus imports minus exports. Parts and accessories not included.

² Production figures include components manufactured by OEM's for their own use.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

¹ Electronic components covered in this report are basically confined to resistors, capacitors, color TV picture tubes, diodes and rectifiers, transistors, and integrated circuits. The term "product category" as used in this publication is confined mainly to these six groups of components.

Sales Opportunities

Components manufactured by U.S. firms are highly regarded in Korea for their quality and specialization. Favorable sales opportunities exist for U.S. exporters of the following electronic components:

Integrated circuits.—Sales of integrated circuits in Korea totaled \$15.2 million in 1972. Imports amounted to \$5.8 million, of which the U.S. share was \$4.2 million, or over 70%.

Demand for IC's, particularly C/MOS digital and single chip MOS/LSI's, is expected to increase significantly starting in 1974 as Korean manufacturers step up production of electronic calculators and clocks. Good sales prospects also exist for suppliers of MSI bipolar digital and linear IC's and power Darlingtons.

Capacitors.—Purchases of capacitors in 1972 amounted to \$3.8 million. Imports were valued at \$1.7 million, of which the U.S. share was a modest 3%.

Demand for tantalum and mica capacitors is particularly high and is expected to rise sharply in the next several years. Sales of fixed electrolytic

and fixed paper and film capacitors also are expected to accelerate through 1977.

Transistors.—The Korean market for transistors in 1972 was valued at \$3.1 million. Purchases from the United States amounted to \$151,000, or 7% of the \$2.3-million import market.

Imports of transistors are expected to increase considerably in the years just ahead. Greatest demand exists for silicon power transistors utilized in the manufacture of switching drives for calculators. Sales prospects also are good for silicon small signal and general purpose transistors and germanium power transistors.

Resistors.—Korea's electronics industry depends on imports to meet its requirements for high quality resistors used in the manufacture of electronic products for export. Imports were valued at \$1.5 million in 1972, accounting for most of the total market of \$1.7 million.

Although American-made products are much preferred, the U.S. share of 1972 imports was only 5%. Trade sources attribute this situation in large measure to the fact that U.S. suppliers are not adequately represented in Korea. American manufacturers are said to have the potential to obtain a much larger share of the markets for fixed composition resistors and for fixed film and variable resistors.

Diodes and rectifiers.—Imports of diodes and rectifiers in 1972 amounted to \$746,000, of which the U.S. share was \$123,000, or 16.5%. Total sales in that year were valued at \$915,000.

Demand will be rising in the next several years, particularly for the following devices: Silicon diodes, used for production of diode arrays; zener diodes, for production of a wide variety of industrial electronic equipment, but especially regulators; and gallium arsenide diodes, for increasing production of switchboards and telephone exchanges. American suppliers also can expect higher sales of germanium diodes (IN34 and IN60) and silicon controlled and power rectifiers.

Other electronic components.—Although U.S. exports to Korea and the following components outside the product category are presently low or non-existent, the anticipated increase in demand for them is expected to offer American manufacturers promising sales opportunities:

- Light-emitting diodes
- Dry reed relays
- Thermistors
- Varistors
- Liquid crystal display components
- Coaxial connectors
- Slide and rotary mechanical switches

Selected End-User Industries

Korea's production of finished electronic products in 1973 was valued at almost \$180 million. Output is expected to increase at an average annual rate of 53% during the next 4 years, and to exceed \$980 million in 1977.

Production of consumer electronic products, estimated at \$138 million in 1973, should grow an average of 54% a year to more than \$780 million in 1977. Exports of these products during the same 4-year period are expected to rise from approximately \$84 million to \$515 million.

Industrial electronic equipment output should increase at an average annual rate of 48%, rising sharply from \$40 million in 1973 to more than \$190 million in 1977.

Some idea of the relative importance of sectors within the Korean electronics industry can be obtained from the following statistics on 1972 output of electronic end-products:

	Value (\$ Million)	Market Share (Percent)
Consumer electronic products		
TV receivers (black-and-white)	33.0	59.7
Radio receivers	12.1	21.9
Cassette tape recorders	7.4	13.4
Amplifiers	1.1	2.0
Other	1.7	3.0
Total	55.3	100.0
Industrial electronic products		
Automatic switchboards and exchanges	12.3	48.6
Electronic calculating machines	2.1	8.3
Automatic telephone sets	1.9	7.5
Terminal equipment for carrier-current systems	1.4	5.5
MW transceivers	1.0	3.9
Indicating instruments	0.8	3.2
SSB transceivers	0.7	2.8
Common battery switches and exchanges	0.7	2.8
Other	4.4	17.4
Total	25.3	100.0

Foreign firms, through direct investment in wholly owned subsidiaries and joint ventures and through technical licensing agreements, have played a pre-eminent role in bringing the electronics industry in Korea to its present level of production. As of June 30, 1973, foreign equity investments totaling over \$86 million had been approved for 120 different enterprises, as shown below (value in millions of U.S. dollars):

	U.S.		Japan		Other		Total	
	No.	Value	No.	Value	No.	Value	No.	Value
Foreign-owned								
subsidiaries	15	31	26	31	2	1	43	62
Joint ventures	18	6	57	15	2	3	77	24
Total	33	37	83	46	4	4	120	86

Locally owned companies account for approximately 46% of Korea's total output of electronic products (including components); foreign owned subsidiaries for 35%; and joint ventures for 20%.

There are some 120 firms in Korea engaged in manufacturing finished electronic products. A few large companies account for the bulk of their combined output. At the end of 1972, there were 42 producers of consumer electronic products and 77 makers of industrial electronic equipment.

Despite some efforts to introduce advanced production methods, Korea's electronics industry is still in a very early stage of development. Its engineering and design capability has been limited primarily to simple production and assembly methods provided under technical licensing agreements, mostly with Japanese firms. Korean manufacturers rarely possess sufficient know-how to modify designs or to develop new products on their own. Government authorities have just begun to encourage improvement in this field.

Korea exported slightly more than 50% (\$92 million) of its production of finished electronic products in 1973. The Korean Government has formulated specific programs under the Electronics Industry Promotion Plan designed to encourage the industry to reach an export goal of \$1.8 billion in 1980. This will require a total capital outlay of close to \$500 million by 1977 and nearly \$1.5 billion by 1980 for the construction of approximately 280 new electronic products manufacturing plants (200 for consumer products and 80 for industrial equipment). An estimated 21 different electronic end-products currently are produced in Korea. This number is expected to increase to 27 by 1977.

Under the Electronics Industry Promotion Plan, the Government is making available to the industry low-interest, government-subsidized bank loans and is protecting it from the competition of foreign imports. The Government also is providing incentives to foreign firms to enter into joint ventures and technical licensing agreements with Korean companies. These incentives include tax concessions and the simplification of administrative procedures for imports and exports. Joint venture companies may also sell up to 40% of their production on the local market. The Government anticipates that its programs will further encourage industry expansion by providing improved working conditions in the industry and assuring an adequate supply of skilled manpower through training programs.

Consumer products sector.—Television receivers make up the largest portion, in value terms, of domestic output of consumer electronic products. They accounted for 63% of 1972 production, while radios followed with 22% of output.

Approximately 700,000 black-and-white TV receivers valued at \$63 million were produced in

Korea in 1973, compared with 360,000 sets worth \$33 million produced in 1972. Output is expected to grow at an average annual rate of 30% (in value terms) during the 1973-77 period, reaching \$184 million or almost \$3 million sets in the latter year. Trade sources estimate that exports will account for approximately \$109 million of this total and domestic consumption for the remaining \$75 million.

There is no color television transmission in Korea and there has been no domestic production of color TV receivers there. Approximately 100,000 color sets, worth over \$20 million, are expected to be produced in 1974. Annual output is forecast to reach 1 million sets valued at \$250 million by 1977.

Four firms together account for over 80% of Korean output of monochrome TV receivers. They are Gold Star Co., Ltd., which accounts for 44% of the total; Samsung-Sanyo, with a 16% share; Tai-Han Electric Wire Co., Ltd., with 13%; and Dong-Nam Electric Ind. Co., Ltd., with 8%.

Most TV set producers currently operate under licensing agreements with Japanese firms. The A-Nam Industrial Co., Ltd., recently established a \$1-million 50/50 joint venture—Korea National Electrical Equipment Co.—in association with Mitsushita Denki of Japan. This company will be the first manufacturer of color TV sets in Korea; 1974 monthly output is expected to be 10,000 sets. The Government also has approved a project for the production of 300,000 color TV sets and 120,000 black-and-white sets annually by Deahan Precision Co. under a licensing agreement with Victor of Japan.

Production of radios in Korea in 1972 totaled 1.8 million units (including car radios) valued at more than \$12 million; production in 1973 reached an estimated 2.5 million radios worth almost \$40 million. Output is forecast to increase in value at an annual rate of 33% during the next 4 years, reaching well over \$115 million (more than 9 million radios) in 1977. Exports in that year are expected to reach almost \$100 million.

Over 60% of the total output of radios is produced by six companies: Gold Star Co., which accounts for 18% of total production; Shinsung Electric Co., with a 15% share; Nam-Sung Heung Up, 10%; Dong-Nam Electric Co., 8%; Taihan Electric Wire Co., 6%; and Chun II Sa, 5%.

Expansion plans call for the construction of 23 new radio manufacturing plants by 1977 and 75 plants by 1980.

There are no subsidiaries or licensees of U.S. firms engaged in Korea's television and radio manufacturing/assembly operations.

Production of tape recorders, valued at \$25 million in 1973, is expected to expand at an average annual rate of nearly 50% during the next 4 years. Output in 1977 should surpass \$125 million, of which \$95 million is expected to be exported.

Cassette tape recorders presently account for 99% of total tape recorder production; 8-track cartridge type sets account for most of the remainder.

Output of phonographs is expected to increase an average of 85% a year during the 1973-77 period, surging from \$3 million to almost \$35 million. Exports in the latter year should reach \$16 million.

Production of amplifiers in 1973 totaled an estimated \$5 million and is likely to increase at an average annual rate of about 50% in the next 4 years. Based on this projection, output in 1977 should reach \$25 million, of which \$13 million would be for local consumption and \$12 million for export.

Other consumer electronic products produced in Korea include tape-players (including car stereos), record players, speaker systems, hearing aids, and videotape recorders. Production of these and similar items is projected to increase from \$4 million in 1973 to almost \$50 million in 1977.

The Competitive Environment

There presently are 135 electronic components manufacturers in Korea. Trade sources estimate that \$555 million will be invested in the construction of new plants by 1980. There are some 29 different types of electronic components currently manufactured in Korea. This number is expected to increase to 40 by 1980.

Korea's 1972 total output of electronic components was valued at \$127 million. As a result of the Government's efforts to expand production for export and to increase the local content of domestically assembled electronic products, output is expected to increase at an average annual rate of more than 30% in the next several years. At this rate of growth, production in 1977 should reach close to \$700 million, up from approximately \$230 million in 1973.

Korean exports of electronic components in 1972 totaled \$103 million, of which \$76 million represented exports by manufacturing subsidiaries of foreign firms. Motorola Korea, Ltd., Signetics Korea Co., Ltd., and Fairchild Semiconductor (Korea) Ltd., the subsidiaries of three major U.S. firms manufacturing electronic components in Korea, accounted for approximately 44% (\$45 million) of total 1972 exports. A-Nam Industrial Co., Ltd., the largest Korean-owned components firm, had exports totaling \$10 million. Under the Government's Electronics Industry Promotion Plan, exports of components are projected to rise from \$178 million in 1973 to a 1977 total in excess of \$430 million.

Two major manufacturers of consumer electronic products in Korea, Gold Star Co. and Taihan Electric Wire Company, are producing components. Gold Star Electronics Co., an affiliate of Gold Star Co., produces silicon transistors both for export and

for the domestic market in technical collaboration with the U.S. firm, National Semiconductor Corporation. The company plans to expand its product line to include IC's, SCR's, and diodes. Taihan Electric Wire Co. produces capacitors.

About one-third of the components used in manufacturing black-and-white TV sets are produced in Korea; most of the remainder are imported from Japan. Government plans call for raising the domestic content of color TV sets from 25% in 1974 to 90% in 1980.

Production of integrated circuits in 1972 was valued at \$48.8 million, accounting for more than 38% of total output of product category components. The Korean industry manufactures digital and linear thick film and MOS IC's. Subsidiaries of Motorola and Signetics produce digital and linear IC's and account for two-thirds of total IC production. Korean Micro-Systems, Inc. is the only manufacturer of MOS/IC's in Korea. Thick film IC's are produced by A-Nam Industrial Co. and Minsung Electronics Industrial Co., Ltd.

Transistor production, valued at \$26.6 million in 1972, accounted for nearly 32% of total output of product category components. Most of the production is exported. Silicon transistors account for over 99% of output; phototransistors account for the remainder. The Motorola and Fairchild subsidiaries produce 60% of Korea's transistor output.

Trade Practices

Imports of electronic components similar to types produced locally are restricted and require advance approval by the Korean Electronics Industries Association. These restrictions are waived, however, for imports associated with foreign investment projects approved under the Foreign Capital Inducement Law, or where the locally made product does not meet the reasonable precision and quality standards for a specific application.

Advance cash deposits are required prior to issuance of the letter of credit for nearly all imports made by the private sector. These deposits exceed 110% of the cost, insurance, and freight (c.i.f.) value for imports of most commodities financed with Korea's foreign exchange.

Korea—The Electronics Industry	
(Basic Data 1972)	
Total value of production:	\$208 million
Number of manufacturers:	283
Industry labor force:	52,501
Output of principal electronic components user industries:	
television sets	\$33 million
telecommunications equipment (est.)	\$18 million
radios	\$12 million

The Netherlands

Steady expansion in Dutch output of telecommunications equipment, computers, and electronic instruments and industrial control equipment is expected to stimulate substantial growth in demand for electronic components in the years just ahead.

The Dutch market for the selected groups of electronic components covered in this report¹ rose from \$80 million in 1972 to over \$88 million in 1973 (see table 1). Based on a predicted average annual growth rate of more than 10%, the market is projected to exceed \$135 million in 1977.

Dutch imports of components within the product category totaled more than \$125 million in 1972. Imports of capacitors were valued at \$37.6 million; color TV picture tubes, \$32.6 million; transistors, diodes and rectifiers, \$31.8 million; resistors, \$16 million; and integrated circuits (IC's), \$7.4 million. A considerable portion of these imports were re-exported.

U.S. manufacturers of electronic components hold an estimated 40% share of the total Dutch market for semiconductors. They dominate the integrated circuit market and hold strong positions in sales of power transistors, power diodes, and connectors. Their share of the resistor and capacitor markets is modest.

Table 1.—The Netherlands: Size of market for selected groups of electronic components,¹ 1972-77
(in millions of U.S. dollars)

Description	1972	1973	1974	1975	1976	1977
Resistors	15.0	15.9	16.9	17.9	18.9	20.0
Capacitors	20.0	20.8	21.6	22.5	23.4	24.4
Color TV picture tubes	20.0	23.0	26.5	30.5	35.0	40.0
Diodes and rectifiers .	6.0	6.7	7.5	8.4	9.5	10.6
Transistors	9.0	9.9	11.1	12.3	13.7	15.2
Integrated circuits ...	10.0	12.0	14.4	17.3	20.8	25.0
Total	80.0	88.3	98.0	108.9	121.3	135.2

¹ Parts and accessories not included.

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

Sales Opportunities

The following electronic components are expected to offer U.S. exporters the most promising sales potential in the Netherlands during the next four years:

¹ Electronic components covered in this report are basically confined to resistors, capacitors, color TV picture tubes, diodes and rectifiers, transistors, and integrated circuits. The term "product category" as used in this publication is limited to these six groups of components.

Capacitors.—The market for capacitors is projected to increase from the 1973 level of \$20.8 million to over \$24 million in 1977. Fixed electrolytic capacitors and fixed paper and film capacitors will be in greatest demand.

Resistors.—Sales of resistors in the Netherlands are forecast to advance to 25% over the period 1973-77, rising from \$15.9 million to \$20 million. Greatest sales growth is predicted for fixed wire-bound and variable resistors.

Integrated Circuits.—Integrated circuits have the highest sales potential of all electronic components in the Dutch market. Sales should more than double during the 1973-77 period, climbing from \$12 million to \$25 million. IC's are rapidly displacing discrete components in an ever growing range of electronic end products manufactured in the Netherlands. U.S. companies and their overseas subsidiaries are the principal suppliers of IC's to Holland, with the bulk of shipments coming from the United States. Power Darlington and C/MOS, MSI and linear IC's all have excellent sales potential.

Transistors.—The Dutch market for transistors is expected to rise at an average annual rate of more than 11%—from \$9.9 million in 1973 to over \$15 million in 1977. Silicon power transistors offer the best sales opportunities because of their growing use in both industrial and consumer products. Dutch industry sources caution that the market may decline if power transistors become outmoded by further developments in integrated circuits. Demand for small signal and general purpose silicon transistors is expected to remain strong at least through 1977.

Diodes and rectifiers.—Sales of diodes and rectifiers are forecast to increase from \$6.7 million in 1973 to approximately \$10.6 million in 1977—an average annual growth rate of more than 12%. Demand will be strongest for silicon diodes, zener diodes, diode arrays and power rectifiers.

Other electronic components.—Electronic components outside the product category expected to have high sales potential in the Netherlands include:

- Photoelectron tubes
- Thyristors
- Photosensors
- Rack and panel connectors
- Cylindrical or circular connectors
- Coaxial connectors
- Printed circuit connectors
- Dry reed and mercury wetted relays
- Slide and rotary switches

Selected End-User Industries

The industrial/commercial equipment sector is more important than the consumer products sector in the Netherlands in volume demand for electronic components. The most important products manufactured within this sector are telecommunications equipment, computers, business machines, electronic instruments and industrial control systems.

Holland's electronic equipment industry is dominated by one firm, N. V. Philips Gloeilampenfabrieken of Eindhoven. Philips is the leading manufacturer in the industrial/commercial equipment sector and totally dominates the smaller consumer products sector. This company, which reportedly produces more than 90% of the country's electronics output, is the Netherlands' only manufacturer of computers, TV's, radios, and stereo systems. Along with its subsidiaries, it is the largest consumer of electronic components, accounting for an estimated 60% of the total market.

The outlook for growth in sales of electronic end products by Dutch manufacturers was considered extremely bright until recently, but the possible impact of the oil boycott has clouded growth forecasts, at least for 1974. In terms of the domestic economy, present projections indicate that growth of the Dutch GNP will be minimal in 1974. Other European countries may be hit even harder. This will undoubtedly have some negative effects on the market for both consumer and industrial/commercial electronic end products, since much of the Dutch production is exported to other European countries. Of the two sectors, however, the industrial/commercial equipment sector should be the less affected.

Purchases of high-price consumer electronic products may be postponed over the long run if budgets are severely tightened. On the other hand, a slowdown in the economics of major European countries should not greatly dampen the demand for labor saving industrial/commercial equipment, since companies will still be seeking to cut costs to offset sharply rising labor rates. Thus, sales of such products as business machines, computers, and automated industrial control systems should continue to grow, although perhaps at a slower pace than previously expected.

The electronic control and instrumentation industry is well developed in Holland. While Philips is the leading manufacturer, there are approximately 75 small and medium-size companies engaged in the manufacture of industrial, scientific and medical instruments and controls. Annual Dutch production of instruments is estimated at around \$100 million. Strong growth is forecast for this industry, with domestic demand rising sharply for instruments used in the medical field, natural gas industry and pollution control areas.

The telecommunications industry likewise should

remain strong as Dutch telephone companies carry out programs to upgrade their mechanical telephone exchanges to electronically controlled systems. Holland's Post, Telephone and Telegraph (PTT) authority is expected to invest more than one billion dollars over the next five years in the procurement of such systems.

N.V. Philips Gloeilampenfabrieken.—Philips is the largest electrical equipment manufacturer in the world and the third largest company outside the United States. It has production facilities in more than 40 countries and sales subsidiaries in 60 countries; it employs more than 360,000 people worldwide. The company's sales in 1972 were reported to total \$6.2 billion. The world headquarters of Philips is in Eindhoven in south-central Holland.

Philips has plants producing electronic equipment in 37 towns and cities in Holland. The greater portion of the company's consumption of electronic components in the Netherlands is in its plants producing industrial/commercial equipment, specifically telecommunications equipment, computers, and electronic instruments and controls for industrial use.

Philips Telecommunicatie Industrie B.V. (P.T.I.), a subsidiary of Philips Gloeilampenfabrieken, employs 7,200 people in Holland at plants in Hilversum (3,330 employees), The Hague (1,030), Horn (310), Huisen (1,900), Amersfoort (120), and Laarwarden (520). P.T.I. produces radio communications equipment, mobile telephones, telephone transmission equipment, and automatic telephone and telegraph systems.

Philips Electrológica B.V. in Apeldoorn is Philips' computer subsidiary, specializing in minicomputers and medium-size general purpose computers. It is the only company producing such equipment in Holland. The company also produces computer peripherals and data transmission equipment.

Other Philips subsidiaries producing electronic end products in the Netherlands are Hollandse Signaalapparaten B.V. (defense systems) and Ven Der Heem Electronics (sonar, radar and other special electronics systems for military and space applications).

Philips, along with CII of France and Siemens of Germany, announced in July 1973 the formation of Unidata, a holding company designed to better compete with U.S. computer firms by pooling European computer know-how and marketing resources. The scope of the new company's activities is not yet known. The three member firms are reported to have a 12.5% share of the European computer market.

Medical systems are produced at Philips' plants in Eindhoven. The Philips Products for Industrial Use Group (IPT), has plants in Eindhoven and Enschede which produce electronically controlled industrial machines, automatic typesetting equipment, process control panels, and a variety of industrial and scientific instruments.

Philips reportedly produces approximately 75% of its electronic components requirements for these industrial products, including many advanced devices such as MOS and MSI integrated circuits. However, the company is said to lag in the very latest integrated circuit developments, such as digital IC's, and buys these devices mainly from outside suppliers. It is especially in these advanced areas that U.S. component suppliers will find growing market potential in the Netherlands.

Other leading domestic electronics firms.—In addition to Philips, the following large foreign companies also produce electronic end products in Holland: the U.S. firms IBM and ITT; L. M. Ericsson of Sweden; and Germany's Siemens. Other important producers are: Singer Friden (accounting machines); Rank Xerox (copiers); Koppens Automatic (control systems); Tektranix N.V. (oscilloscopes); Vitatron Medical (laboratory equipment); and Cordis Europa and Medtronic (pacemakers).

A major customer for electronic components, though not an end-user, is the Dutch Purchasing Office in Rijswijk, which buys large quantities of components for the Dutch Government for use in laboratories and other government facilities.

The Competitive Environment

Total domestic production of electronic components within the product category was estimated at more than \$150 million in 1972. Output of color TV picture tubes was reported to exceed \$50 million; transistors, diodes and rectifiers, \$45 million; capacitors, \$25 million; resistors, \$20 million; and integrated circuits, \$9 million to \$10 million.

Dutch exports of the components surveyed totaled almost \$200 million in 1972. Exports of color TV picture tubes were valued at \$65.8 million; transistors, diodes and rectifiers, \$61.5 million; capacitors, \$42.5 million; resistors, \$22.2 million; and integrated circuits, \$7 million.

Philips is the only manufacturer of semiconductors, capacitors and resistors in the Netherlands. The company also manufactures connectors locally. Figures on Philips' production and sales of electronic components are not available. However, in-

dustry sources report that Philips supplies about 55% of the semiconductor market.

Philips employs approximately 13,000 people in the production of electronic components and component parts in the Netherlands. Production of the firm's capacitors, resistors and diodes is completely automated, while manufacturing of the more complex devices is accomplished by automated but separate steps.

Philips is reported to be concentrating on the linear and consumer IC market, which it dominates in Europe. About a year ago it developed the LOCMOS (isoplaner IC). The firm is expected to begin large scale production of digital IC's once it feels assured of a larger market for its computers.

Rising wages in the Netherlands have forced Philips to seek lower cost sources of labor for the highly labor intensive assembly of electronic components. The company increasingly is gearing its efforts in Holland to research and development and to the highly technical manufacture of component materials and parts, much of which is then exported to assembly plants in Singapore, Taiwan and India.

There are only a few other manufacturers of electronic components in the Netherlands. Among these are Semikron Nederland B.V., a small firm producing diode bridges; AMP Holland B.V., a subsidiary of the U.S. firm AMP, Inc., manufacturing connectors; and Berg Electronics N.V., a subsidiary of Berg Electronics Inc., also making connectors.

The Netherlands—Selected Indicators

(1972)

Gross national product:	\$46.9 billion
Population:	13.3 million
Total country imports:	\$14.4 billion
Imports from U.S. (w/share of total):	\$ 1.4 billion (9.7%)
Total country exports:	\$14.3 billion
Exports to U.S. (w/share of total):	\$630 million (4.4%)
Exchange rate (May 1974):	2.60 guilders=US\$1

Spain

The total Spanish market for electronic components was valued at approximately \$100 million in 1972 and is expected to reach \$160 million in 1977, representing an average annual growth rate of nearly 10%.

Spain's domestic production of components in 1972 was estimated at \$65 million. Imports totaled nearly \$50 million, and exports were valued at \$15 million.

Approximately 36% (\$18 million) of the country's 1972 total imports of electronic components consisted of resistors, capacitors, TV picture tubes, transistors, diodes and rectifiers, and integrated circuits. The U.S. share of the import market for these six groups of components was valued at \$2.5 million, or nearly 14% of the total (see table 1).

American manufacturers supply 25% of Spain's semiconductor imports. Semiconductors, particularly transistors and integrated circuits, will continue to have the highest sales potential for U.S. exporters during the next several years.

Selected End-User Industries

The industrial/commercial equipment sector of Spain's electronics industry is a much more important market for U.S. exporters than the consumer products sector. Domestic production of industrial/commercial equipment increased at an average annual rate of about 20% between 1969 and 1972, while output of electronic consumer goods rose at an average rate of 4% annually during this period. Production of telecommunications equipment totaled roughly \$300 million in 1972; professional electronic equipment, \$27 million; and electronic consumer products, \$170 million.

The consumer products sector depends heavily on domestically manufactured electronic components. Approximately 60% of Spain's components production is consumed by this sector. Local producers of industrial/commercial equipment, on the other hand, continue to rely mainly on imports for their component requirements, particularly for advanced components which Spanish manufacturers are not in a good position to supply.

The Spanish *telecommunications equipment industry* is already a valuable part of the economy in terms of supplying the domestic market. Not only is it a major foreign exchange earner, but it is pursuing an ambitious research program. The industry's output is expected to rise at a 20% average annual rate through 1977. This strong growth will

be sustained by plans of the national telephone company (Compania Telefonica Nacional d'España—CTNE) to install 2.5 million new telephones and to automate its central exchanges during the next few years.

Spain's total 1972 market for telecommunications equipment amounted to approximately \$323 million, up 26% over the 1971 level. Domestic production of almost \$300 million met most of the country's requirements and accounted for \$23 million worth of exports.

The Spanish telecommunications industry is dominated by members of the ITT group operating in the country, including Standard Electrica, S.A.; Marconi Espanola, S.A.; Cia. International de Telecommunications Electronicas, S.A. (CITESA); and International Telephone and Telegraph Corporation de Espana, S.A.

Total sales by Standard Electrica, the largest of the ITT subsidiaries, amounted to \$256 million in 1972. The bulk of this figure comprised sales of telecommunications equipment; sales of electronic components accounted for most of the remainder.

Marconi Espanola registered some \$45 million in sales in 1972, with telecommunications equipment again the most important line. The third ITT Spanish subsidiary, CITESA, had sales in the neighborhood of \$15 million. It produced 1.5 million telephones in 1973, of which 1 million were exported.

The ITT group firms collectively employ over 23,000 people, making the group one of the largest employers in the country.

ITT's Spanish subsidiaries operate independently of each other and, although there is a natural inclination to buy from sister companies both in Spain and abroad, each is obliged to buy outside the group if outside suppliers are more competitive. The Spanish member firms obtain most of their requirements for electronic components from foreign sources, since they consider that the demand by the entire ITT group in Spain does not justify domestic production of components except in a few specific cases. Because of its apparent reluctance to manufacture components domestically and its policy of buying from the most competitive source, the ITT group can be regarded as the largest single market in Spain for U.S. exporters of electronic components.

The *professional electronics equipment industry* represents a small but growing market for electronic component producers. Domestic output of professional electronic equipment currently meets less than

15% of the demand in Spain, and for this reason the government has designated the industry as a priority area for development. Output is projected to rise at an average annual rate of 15% during the next few years, reaching about \$55 million in 1977.

Output by Spain's *consumer electronic products industry* should experience substantial growth beginning in 1975, when color TV transmission is expected to be introduced. Local production of color televisions sets is expected to strongly stimulate the country's demand for electronic components.

The Competitive Environment

Of the ten leading manufacturers of electronic components in Spain, nine are subsidiaries of foreign firms. The notable exception is Piher, S.A., which has its own subsidiaries in other countries and will soon open a manufacturing plant in Boston, Massachusetts. Piher's main product line is resistors. It produces 7 million carbon film resistors a day, of which 6 million are exported. It also manufactures 5 million potentiometers per month, exporting 75% of this output. The United States is the company's largest customer for both products. Piher's 1972 output of semiconductors was valued at \$165,000. Production of integrated circuits was initiated in 1973. Piher also manufactures finished electronic equipment, including television cameras and FM repeaters. Total sales for all products in 1972 amounted to \$23 million, of which \$9 million was exported.

The ITT subsidiaries are the leading U.S.-owned firms manufacturing electronic components in Spain. Their output is geared mainly to components utilized in telecommunications equipment, although they also make some devices for professional and consumer electronic products.

Miniwatt, the manufacturing arm of the Philips-owned Cia. de Productos Electronicos (COPRESA),

is the leading TV picture tube producer in Spain. Its entire output of color picture tubes (about 300,000 units a year) is exported.

Miniwatt also manufactures semiconductors for low frequency applications in both high and low power. Output of these semiconductors is consumed locally. The company has not yet made a decision to produce integrated circuits.

Other foreign firms manufacturing electronic components in Spain are Philips Iberica, AEG Iberica de Electricidad (Telefunken), and Telefunken Radiotechnica Iberica. These companies produce components chiefly for use in their consumer electronic products.

Import duties.—Imports of electronic components into Spain are subject to a complex system of tariffs of varying amounts. Information on duty rates applicable to specific components may be obtained from the U.S. Department of Commerce, Domestic and International Business Administration, Room 4217, Main Commerce, Washington, D.C. 20230. There are no quantitative restrictions or other non-tariff barriers on imports of electronic components.

Table 1.—Spain: Total imports, and U.S. share of total imports, of selected groups of electric components, 1972

(in thousands of U.S. dollars)

	Total imports	Imports from the United States	U.S. share (percent)
Resistors	4,075	346	8.5
Capacitors	5,022	308	6.1
TV picture tubes	2,932	256	8.7
Transistors, diodes, rectifiers and integrated circuits .	6,045	1,564	25.9
Total	18,074	2,474	13.7

Source: U.S. Department of Commerce, Bureau of International Commerce market survey.

IV. U.S. Government Assistance Available to Exporters

Export Information and Overseas Business Opportunities Services

The U.S. Department of Commerce, the largest source of export marketing information for U.S. industry, provides a wide range of information services designed to assist U.S. firms to develop and expand their export markets and overseas business activities. Recently modernized data handling and retrieval techniques now make these services available in a fraction of the time previously required.

Export Information Services

The export information services described below can be obtained by contacting the U.S. Department of Commerce, Office of Export Development, Export Information Division, Room 1033, Washington, D.C. 20230, or the nearest of the Department's 42 district offices.

World Traders Data Reports

World Traders Data Reports (WTDR's), formerly known as World Trade Directory Reports, provide descriptive background information on specific foreign firms. Prepared by the U.S. Foreign Service, the WTDR's include such information as year of establishment, method of operation, lines handled, size of sales territory, name of chief executive, general reputation in trade and financial circles, names and addresses of credit sources, names of the firm's trading connections, and other commercial information. The complete name, street and city address of the foreign firm must be given when requesting this service. The price is \$15 per report.

Agent/Distributor Service

The Agent/Distributor Service (ADS) is designed for the businessman who needs assistance in identifying potential foreign agents or distributors. The information, which is provided by the U.S. Foreign Service, consists of up to three names of such prospects. Up to 30 days are required from date of receipt to complete the request. The charge for this service is \$25.

Export Mailing List Service

The Export Mailing List Service (EMLS) provides lists of foreign firms considered suitable for export

contact purposes. Firms are drawn from the automated Foreign Traders Index. Their names and addresses are available on gummed mailing labels or in standard printout form. Printouts also include: Name and title of an officer, type of organization, year of establishment, relative size, number of employees and salespersons, and product and/or service codes (Standard Industrial Classification numbers). A basic "set-up" payment of \$15, applicable to each retrieval, must accompany each request.

This charge covers payment for up to 300 printed names. An additional 5 cents is charged for each name above 300. Delivery can be made in about 15 days.

Foreign Traders Index (FTI) Data Tape Service

This service is offered as a convenience to firms that have a continuing need for a broad range of foreign commercial data, such as export management firms selling a wide range of products. This service provides, in magnetic tape form, information on all firms in one or more countries covered in the Foreign Traders Index. Users may thus retrieve various segments of FTI data by running tapes through their own computer facilities. The charge for this service is \$177 per country up to 15 countries. The costs of the data for 15 or more countries or for the entire file is \$2,500.

Business Counseling Service

Business counseling services are provided both at the U.S. Department of Commerce in Washington and at the Department's 42 district offices. Visitors to Washington are served by the Business Counseling Section, which provides in-depth counseling and schedules appointments with appropriate officials within the Domestic and International Business Administration as well as with officials in other agencies.

Overseas Business Opportunities Services

The overseas business opportunities services described below can be obtained by contacting the U.S. Department of Commerce, Office of Export

Development, Overseas Business Opportunities Division, Room 2323, Washington, D.C. or the nearest of the Department's 42 district offices.

Trade Opportunities Program

The Trade Opportunities Program (TOP) receives daily up-to-date trade leads from over 200 Foreign Service posts around the world and disseminates them to U.S. suppliers. Trade opportunities are based on inquiries by overseas companies who wish to purchase American products or services, or who are interested in representing U.S. firms. Trade opportunities may come from private commercial organizations, from foreign governments, or even from multinational organizations such as NATO or the UN.

To register for TOP, U.S. firms specify their product and country interests and the types of commercial information they want—direct sales, representation, and/or foreign government tenders. As leads are developed by the Foreign Service, they are cabled to Washington, where they are matched by computer against the criteria established by U.S. companies. These leads are then mailed to appropriate U.S. firms within a week of their origination overseas. Trade leads are charged against prepaid subscriptions, which are available for as little as \$25 for 50 leads; larger subscriptions are also available at \$50 and \$125.

Overseas Product Sales Group

The Overseas Product Sales Group (OPS) provides personalized assistance to TOP subscribers, or to firms identified as having high export capability, in bidding against foreign competitors for specific export sales opportunities with a value of \$1 million or more. The OPS specialists collect, inventory and disseminate early information on export sales opportunities from TOP and a variety of other sources.

Foreign Investment Services Staff

The Foreign Investment Services Staff (FISS) is the focal point for American and foreign business inquiries relating to U.S. investment and licensing abroad. American businessmen are assisted in locating potential overseas licensees and partners, are provided with investment data on specific regions and countries, and are then guided toward sources of capital for these proposed projects. Foreign investment and licensing proposals for which U.S. participation and technology is sought are published regularly in *Commerce Today* and are brought to the direct attention of American firms where appropriate. In carrying out its broad range of activities, FISS works closely with other U.S. Government assistance sources, multinational agencies and private regional investment organizations.

FINANCING EXPORT SALES

The Export—Import Bank of the United States

The Export-Import Bank of the United States (Eximbank) is an independent agency of the U.S. Government which works directly with American suppliers and private financial institutions to finance U.S. export sales. Eximbank has over 20 financing programs to assist U.S. firms. These include direct loans, bank guarantees, discount facilities, leasing guarantees, and other programs to cover overseas design and engineering studies, construction operations, licensing technology, and agricultural export financing.

Financing packages for major industrial projects and exports of high value products are normally supported under Participation Financing, a combination of the Direct Loan and Financial Guarantee programs.

Direct Loans are dollar credits extended by Eximbank to borrowers outside the United States for purchases of U.S. goods and services. Disbursements under the loan agreement are made in the United States to the suppliers of the goods and services, and the loans, plus interest, are repaid in dollars by the borrowers.

Eximbank will extend its Financial Guarantee to cover loans made by U.S. financial institutions to foreign government or private purchasers of U.S. goods and services. The Financial Guarantee will unconditionally guarantee repayment by a borrower of up to 100% of the outstanding principal due on such loans plus interest equal to the U.S. Treasury rate for similar maturities, plus 1% per annum on the outstanding balances of the loan. Comparable guarantees are available to non-U.S. financial institutions under somewhat different terms.

Participation by private financing institutions is required in any transaction seeking Eximbank direct lending. If requested by the private lender, Eximbank may extend its Financial Guarantee to assure repayment of the private party's portion of the total financing. Eximbank will often allow repayment of the private lender's portion of the loan first, and since this portion normally carries a higher rate of interest, this reduces the effective interest cost to the borrower.

Of particular importance to U.S. businessmen is Eximbank's Cooperative Financing Facility pro-

gram which supports medium-term financing in all major markets. Eligible overseas banks are extended a line of credit for half the funds needed for each transaction, presently at 7% interest, and the co-operating banks provide the other half at local market rates. These banks make credit judgments regarding the customer and can consummate transactions with a minimum of difficulty. Eximbank currently has established approximately 300 such working arrangements with foreign financial institutions (private and public) in over 100 countries.

Eximbank's Commercial Bank Exporter Guarantee program, another activity of special interest to exporters, provides guarantees covering the credit and political risks of non-payment of medium-term (181 days to 5 years) export debt obligations purchased by U.S. banking institutions on a non-recourse basis from the exporters. The fee charged for Eximbank's guarantee depends upon (1) the classification accorded the country of import, (2) the length of the repayment terms and (3) the financial condition of the overseas buyer.

As a general rule, all transactions supported by Eximbank must include a 10% cash payment by the buyer and must have reasonable assurance of repayment.

The Bank is directed by statute to supplement and encourage private capital, not compete with it. Selected product lines and services to designated markets are excluded from the agency's support; however, the overwhelming majority of U.S. export products and markets are covered. Details on the exceptions are available from U.S. commercial banks or directly from Eximbank.

Businessmen are specifically invited to utilize Eximbank's counseling services for exporters, banks and financial institutions seeking financing for U.S. exports. The services include information on the availability of financing within the United States and abroad, as well as on each of the pertinent Eximbank programs.

For additional information, contact the Export-Import Bank of the United States, 811 Vermont Avenue, N.W., Washington, D.C. 20571, or Telex 89-461.

EXPORT CREDIT INSURANCE

The Foreign Credit Insurance Association (FCIA)

The Foreign Credit Insurance Association (FCIA) is an association of 50 stock and mutual insurance companies in partnership with the Export-Import Bank of the United States. It offers a comprehensive selection of credit insurance policies which protect policy holders against loss from failure to receive payment from foreign buyers.

The benefits of this coverage may be summed up as follows:

- It protects the exporter against the failure of the buyer to pay his dollar obligation for commercial or political reasons.
- It enables the exporter to offer foreign buyers competitive terms of payment.
- It supports the exporter's prudent penetration of higher risk foreign markets.
- It gives the exporter greater financial liquidity and flexibility in administering his foreign receivables portfolio.

Who May Be Insured

Virtually any corporation, partnership or individual doing business in the United States is eligible for FCIA coverage. An exporter may apply for a policy for himself or may become insured under the blanket policy of a bank or other financial institution which holds an FCIA policy.

Eligible Products

Foreign sales of all types of industrial, agricultural, and commercial products produced in the United States and of services rendered by U.S.-based personnel are eligible for FCIA insurance.

What Losses Are Covered

Comprehensive FCIA policies protect insureds against nonpayment of receivables due to unforeseeable commercial and political occurrences. Commercial risks which are covered include insolvency of the buyer or protracted defaults which may well arise from economic deterioration in the buyer's market area, shifts in demand, unanticipated competition, tariffs, or technological changes. Also covered are defaults due to such buyer problems as increasing expenses, the loss of key personnel, and natural disasters.

Political risks coverage applies to defaults due to governmental action and to political disturbances such as war, revolution, and insurrection. Such events may result in confiscation of the buyer's assets, detention or diversion of shipments, or cancellation of

necessary licenses by the United States or by the buyer's country. Also covered is the inability or refusal of the foreign central bank involved to convert the buyer's currency to dollars. Political coverage alone is available for exporters who desire to assume their own commercial risks.

The Policies

The policies offered by FCIA are many and varied. They can be tailored to suit the needs of the individual exporters, service groups, and financial institutions. Aside from a small application fee, all premiums are paid only for goods actually shipped.

The Master Policy combines a deductible provision, discretionary credit authority, and once-a-year reporting to provide qualified exporters with lower premiums, independent credit decisions, faster services to overseas buyers, and less paperwork. It is a blanket policy which requires the exporter to insure all or a reasonable spread of his exportation.

The Short-Term Policy is a blanket policy which covers sales on terms of up to 180 days. It provides coverage of 90% for commercial losses and 95% for political losses. A moderate discretionary credit limit is included for each buyer.

The Medium-Term Policy provides 90% coverage (political and commercial) for capital and quasi-capital goods sold on terms of 181 days to 5 years. The policy is written on a case-by-case basis so an exporter need not insure all his medium-term transactions as he would under a blanket policy.

The Combination Policy provides a short- and medium-term insurance to protect U.S. exporters in transactions with overseas dealers and distributors. It includes flexible coverage for short-term sales and for both inventory and receivable financing.

The Global End-User Policy allows exporters to insure the sales of capital goods to end-users through overseas distributors, dealers, and subsidiaries. This program permits title of capital goods to be transferred from the dealer to the end-user and still be eligible for coverage ("on-going sale").

The Comprehensive Services Policy insures the receivables generated by the performance of services for foreign customers by U.S.-based personnel, or by U.S. personnel temporarily assigned overseas. Industries benefiting from this coverage include management consultants, engineering and related construction consulting services, and transportation companies.

Special Policies: The FCIA also provides specially adapted policies for new exporters (the *Small Business Policy*) and for exhibitors in Department of Commerce Trade Shows (the *Exhibitors Policy*.)

Special Coverage Endorsements are available for addition to the above policies. These include endorsements to cover specified preshipment risks and consignment selling.

An Aid to Financing

FCIA does not finance export sales. However, the exporter who insures his accounts receivable against commercial and political risks is usually able to obtain financing from commercial banks and other lending institutions at lower rates and on more liberal terms than would otherwise be possible.

Prequalification of Buyers

FCIA's rapidly expanding prequalifying (P.Q.) program is now providing credit information on over 25,000 overseas buyers through its computerization data system. All the exporter needs to do is telephone the nearest FCIA office to determine whether a particular buyer is prequalified for the amount of his purchase.

Information about FCIA

More information about FCIA's services, and applications for policies, may be obtained through insurance agents or brokers or through FCIA's network of full-service regional offices. General questions and specific inquiries may be directed toward the FCIA Ombudsman in the New York office. Call (212) 432-6216 for a direct connection.

FCIA Offices

One World Trade Center—9th Floor
New York, New York 10048
Phone: (212) 432-6200

Suite 1003—William-Oliver Bldg.
32 Peachtree Street, N.W.
Atlanta, Georgia 30303

Suite 1552
10 South Riverside Plaza
Chicago, Illinois 60606

Suite 1435
55 Public Square
Cleveland, Ohio 44113

611 West Sixth Street
Suite 650
Los Angeles, California 90017

700 North Water Street
Suite 1110—First Federal Bldg.
Milwaukee, Wisconsin 53202

1006 Main Street
C & I Bldg.—Suite 1408
Houston, Texas 77002

1 Embarcadero Center
Suite 2212
San Francisco, California 94111

Woodward Bldg., Suite 539
15th & H Streets, N.W.
Washington, D.C. 20005

TAX DEFERRAL BENEFIT PROGRAM FOR U.S. EXPORTERS (DISC)

Exporters will want to become familiar with the provisions of the Revenue Act of 1971 (Public Law 92-178) which permit U.S. firms to establish Domestic International Sales Corporations (DISC's) entitled to a tax break on export income. Essentially, the DISC is a domestic corporation which meets certain minimal organizational requirements and limits itself almost exclusively to export sales activities. If the corporation derives at least 95% of its income from export sales, lease, or rental transactions, and 95% of its assets are export related, it can defer U.S. income tax on up to 50% of its export income. Tax-deferred retained earnings can be used to expand and promote the DISC's export business and may also be loaned to any domestic producer of export goods, including the DISC's parent company.

DISC's can be formed by manufacturers, non-manufacturers, and export groups. A DISC can function as a principal, buying and selling for its own account, or as a commission agent. It can be related to a manufacturing parent or can be an

independent merchant or broker. Special intercompany pricing rules or transactions between a DISC and a related supplier or manufacturer allow a larger profit to the DISC than would normally be the case under the usual arm's length pricing requirements of the Tax Code.

A corporation wishing to be tested as a DISC must file a statement of election (IRS Form 4876) with the Internal Revenue Service within 90 days preceding the beginning of its tax year, for a corporation already in existence, or within 90 days after the date of incorporation, if newly formed.

The rules for organizing and operating a DISC are comparatively simple. Many U.S. businesses, both large and small, should be able to avail themselves of the advantages of exporting through DISC's.

For further information contact the U.S. Department of Commerce, Office of International Finance and Investment, Foreign Business Practices Division, Washington, D.C. 20230, or phone (202) 967-4471.

DEPARTMENT OF COMMERCE CONTACTS FOR U.S. BUSINESS

Office of Field Operations

The 42 U.S. Department of Commerce district offices listed below represent the Department in their respective localities and assist in carrying out

the programs of the Department. Under the direction of the Office of Field Operations, these district offices are staffed by experienced specialists prepared to help in the solution of business problems and to assist in exporting.

ALBUQUERQUE, NEW MEXICO 87101
U.S. Courthouse—Room 316
Area Code 505 Tel. 766-2386

ANCHORAGE, ALASKA 99501
412 Hill Building
632 Sixth Avenue
Area Code 907 Tel. 265-4597/8

ATLANTA, GEORGIA 30309
Suite 523, 1401 Peachtree St., N.W.
Area Code 404 Tel. 526-6000

BALTIMORE, MARYLAND 21202
415 U.S. Customhouse
Gay and Lombard Streets
Area Code 301 Tel. 962-3560

BIRMINGHAM, ALABAMA 35205
Suite 200-201
908 South 20th Street
Area Code 206 Tel. 325-3327

BOSTON, MASSACHUSETTS 02116
10th Floor, 441 Stuart Street
Area Code 617 Tel. 223-2312

BUFFALO, NEW YORK 14202
910 Federal Building
111 West Huron Street
Area Code 716 Tel. 842-3208

CHARLESTON, WEST VIRGINIA 25301
3000 New Federal Office Building
500 Quarrier Street
Area Code 304 Tel. 343-6181, Ext. 375

CHEYENNE, WYOMING 82001
6022 O'Mahoney Federal Center
2120 Capitol Avenue
Area Code 307 Tel. 778-2220, Ext. 2151

CHICAGO, ILLINOIS 60603
Room 1406
Mid-Continental Plaza Bldg.
55 E. Monroe Street
Area Code 312 Tel. 353-4450

CINCINNATI, OHIO 45202
8028 Federal Office Building
550 Main Street
Area Code 513 Tel. 684-2944

CLEVELAND, OHIO 44114
Room 500, 666 Euclid Avenue
Area Code 216 Tel. 522-4750

COLUMBIA, SOUTH CAROLINA 29204
Forest Center
2611 Forest Drive
Area Code 803 Tel. 765-5345

DALLAS, TEXAS 75202
Room 3E7, 1100 Commerce Street
Area Code 214 Tel. 749-1515

DENVER, COLORADO 80202
Room 161, New Customhouse
19th and Stout Streets
Area Code 303 Tel. 837-3246

DES MOINES, IOWA 50309
609 Federal Building
210 Walnut Street
Area Code 515 Tel. 284-4222

DETROIT, MICHIGAN 48226
445 Federal Building
Area Code 313 Tel. 226-3650

GREENSBORO, NORTH CAROLINA 26402
203 Federal Building
West Market Street, P.O. Box 1950
Area Code 919 Tel. 25-9111, Ext. 345

HARTFORD, CONNECTICUT 06103
Room 610-B, Federal Office Building
450 Main Street
Area Code 203 Tel. 244-3530

HONOLULU, HAWAII 96813
286 Alexander Young Building
1015 Bishop Street
Area Code 808 Tel. 546-8694

HOUSTON, TEXAS 77002
1017 Federal Office Building
201 Fannin
Area Code 913 Tel. 226-4231

KANSAS CITY, MISSOURI 64106
Room 1840, 601 East 12th Street
Area Code 816 Tel. 374-3142

LOS ANGELES, CALIFORNIA 90024
11201 Federal Building
11000 Wilshire Blvd.
Area Code 213 Tel. 824-7591

MEMPHIS, TENNESSEE 38103
Room 710, 147 Jefferson Avenue
Area Code 901, Tel. 534-3214/5

MIAMI, FLORIDA 33130
Room 821, City National Bank Building
Area Code 305 Tel. 350-5267

MILWAUKEE, WISCONSIN 53203
Straus Building
238 West Wisconsin Avenue
Area Code 414 Tel. 224-3473

MINNEAPOLIS, MINNESOTA 55401
306 Federal Building
110 South Fourth Street
Area Code 612 Tel. 725-2133

NEWARK, NEW JERSEY 07102
Gateway Building (4th Floor)
Area Code 201 Tel. 645-6214

NEW ORLEANS, LOUISIANA 70130
909 Federal Office Building, South
610 South Street
Area Code 504 Tel. 527-6546

NEW YORK, NEW YORK 10007
41st Floor, Federal Office Building
26 Federal Plaza, Foley Square
Area Code 212 Tel. 264-0634

PHILADELPHIA, PENNSYLVANIA 19105
10112 Federal Building
600 Arch Street
Area Code 215 Tel. 597-2850

PHOENIX, ARIZONA 85004
508 Greater Arizona Savings Bldg.
112 North Central Ave.
Area Code 602 Tel. 261-3285

PITTSBURGH, PENNSYLVANIA 15222
431 Federal Building
1000 Liberty Avenue
Area Code 412 Tel. 644-2850

PORTLAND, OREGON 97205
Suite 501, Pittock Block
921 S.W. Washington Street
Area Code 503 Tel. 221-3001

RENO, NEVADA 89502
2028 Federal Building
300 Booth Street
Area Code 702 Tel. 784-5203

RICHMOND, VIRGINIA 23240
8010 Federal Building
400 North 8th Street
Area Code 703 Tel. 782-2246

ST. LOUIS, MISSOURI 63103
2511 Federal Building
1520 Market Street
Area Code 314 Tel. 622-4243

SALT LAKE CITY, UTAH 84138
1203 Federal Building
125 South State Street
Area Code 801 Tel. 524-5116

SAN FRANCISCO, CALIFORNIA 94102
Federal Building, Box 36013
450 Golden Gate Avenue
Area Code 415 Tel. 556-5860

SAN JUAN, PUERTO RICO 00902
Room 100, Post Office Building
Phone: 723-4640

SAVANNAH, GEORGIA 31402
235 U.S. Courthouse & Post Office Building
125-29 Bull Street
Area Code 912 Tel. 232-4321, Ext. 204

SEATTLE, WASHINGTON 98109
Room 706, Lake Union Bldg.
Area Code 206 Tel. 442-5615

U.S. Trade Promotion Facilities Abroad

U.S. Trade Promotion Facilities Abroad provide U.S. manufacturers with a unique method of testing and selling in key foreign markets through commercial showrooms established in central marketing areas where the potential for American products is continuous. The Trade Development Office in Warsaw, however, does not have exhibit facilities.

ARGENTINA

Avenida Quintana No. 411
Buenos Aires

AUSTRALIA

37 Pitt Street
Sydney NSW 2000

AUSTRIA

Prinz Eugen Strasse 8-10
A-1040
Vienna

FRANCE

123 Avenue Charles de Gaulle
92200 Neuilly
Paris

GERMANY

Bockenheimer Landstrasse 2-4
D-6000 Frankfurt/Main

IRAN

Queen Elizabeth II Boulevard
and Kh. Attarzadeh
Tehran

ITALY

Via Gattamelata 5
20149 Milan

JAPAN

Tameike Tokyu Building
1-14 Akasaka, 1-Chome
Minato-Ku
Tokyo 107

JAPAN

American Merchandise
Display Osaka
Sankei Kaikan Building
27, Umeda-Cho, Kita-Ku
Osaka

KOREA

American Embassy
82 Sejon-Ro
Seoul

Information on exhibitions at U.S. Trade Promotion Facilities Abroad may be obtained from the U.S. Department of Commerce, Bureau of International Commerce, Office of International Marketing, Washington, D.C. 20230, or the nearest of the Department's 42 district offices.

Listed below are 17 U.S. Trade Promotion facilities located in major cities in Europe, Asia, Australia and Latin America.

LEBANON

American Embassy
Ali Reza Building
Corniche at Avenue de Paris
Beirut

MEXICO

Liverpool No. 31
Mexico 6, D.F.

POLAND

U.S. Trade Development and
Technical Information Office
Ulica Wiejska 20
Warsaw

SINGAPORE

268 Orchard Road
Yen San Building
Singapore 9

SWEDEN

Vasagatan 11
Stockholm

TAIWAN

Nanking East Road
Taiwan Glass Co. Bldg.
Taipei

UNITED KINGDOM

4/5 Langham Place
London W1

U.S.S.R.

The Moscow Commercial Office
c/o American Embassy
Department of State
Washington, D.C. 20520

Office of Export Administration

Information on U.S. export regulations may be obtained from the U.S. Department of Commerce, Bureau of East-West Trade, Office of Export Administration, Washington, D.C. 20230. Telephone: (202) 967-4811.

V. Schedule of Promotional Events

Electronic Components

The schedule of promotional events for 1975 and 1976 lists appropriate activities for promoting sales of electronic components in 17 foreign countries covered in this Survey.

The Schedule provides a chronological listing, by country, covering the following types of promotional activities:

- **International Trade Fairs.**—Privately sponsored, foreign managed international exhibitions in which U.S. firms may exhibit their products on an individual basis.
- **Conferences, Congresses, Seminars and Symposia.**—Privately sponsored, international activities in which U.S. firms may participate on an individual basis. Some of these events are held in conjunction with international trade fairs; others are held independently.
- **U.S. Trade Promotion Facilities Abroad.**—These provide year-round facilities for display and demonstration of U.S. products.

Some of these promotional events feature electronic components while others are oriented primarily to a specific end-user industry. The information for scheduled events was obtained from market surveys and the U.S. Foreign Service. Events are arranged chronologically by country. Some may be subject to change without notice, but at the time of publication were scheduled for the dates and locations shown.

Events sponsored by or participated in by the U.S. Department of Commerce appear in boldface letters on the Schedule.

Additional Commerce-sponsored promotional activities may be scheduled from time to time. These include:

- **Specialized Product Shows** and other marketing activities are held in permanent facilities situated in major business centers. U.S. Trade Promotion Facilities are located in Beirut, Buenos Aires, Frankfurt, London, Mexico City, Milan, Moscow, Osaka, Paris, Seoul, Singapore, Stockholm, Sydney, Taipei, Tehran, Tokyo, and Vienna. A Trade Development Office is located in Warsaw.
- **"Between Show Promotions."**—During periods between major shows, individual U.S. firms, or their authorized representatives, are encouraged to use the above facilities to stage one-company product promotions or sales seminars.
- **Specialized U.S. Trade Missions.**—The U.S. Department of Commerce organizes and sponsors Trade Missions covering selected product themes based on available market research and Foreign Service recommendations, establishes the overseas itinerary, pays the Mission's operating expenses, and provides an Advance Officer and Mission Director.

For further information regarding events sponsored by or participated in by the U.S. Department of Commerce contact any one of the Department's 42 district offices. Additional information on all other events may be obtained from the contact indicated in the Schedule of Events for the particular activity.

Schedule of Trade Promotional Events 1975-1976

EVENT	1975	1976
AUSTRALIA		
ENGINEERING CONFERENCE OF THE INSTITUTION OF ENGINEERS		
Location: (1975) Wrest Point Hotel, Hobart, Tasmania (1976) Townsville, N.S.W.		
Sponsor: The Institute of Engineers, Australia, 157 Gloucester Street, Sydney, N.S.W. 2000	February	May
Frequency: Annual		
FIFTEENTH NATIONAL RADIO AND ELECTRONIC ENGINEERS CONVENTION		
Location: Sydney		
Sponsor: Institution of Radio and Electronic Engineers of Australia 157 Gloucester Street, Sydney, N.S.W. 2000	May	December
Frequency: Held every 18 months		
INSTRUMENTS, AUTOMATION AND ELECTRONIC CONTROL		
Location: (1975) Melbourne Exhibition Hall, Melbourne (1976) Sydney Showground, Sydney		
Sponsor: Metal Trades Industry Assoc., and the Institute of Instrumentation and Control (Jointly), 508 Pacific Highway, St. Leonards, N.S.W.	July	September
Frequency: Annual		
CETIA—THE CONTROL, ELECTRONICS TELECOMMUNICATIONS, INSTRUMENT AND AUTOMATION EXHIBITION		
Location: RAS Showgrounds, Sydney		
Sponsor: Electronics Assoc. of Australia, 105 Walker Street, North Sydney, N.S.W. 2060	October	October
Frequency: Annual		
INTERNATIONAL ORGANIZATION FOR MOTOR TRADES AND REPAIRS		
Location: Melbourne		
Sponsor: Australian Automobile Chamber of Commerce, 464 St. Kilda Road, Melbourne, Victoria 3000	November	
Frequency: Annual (but in different country each year)		
BELGIUM		
INTERNATIONAL ELECTRONICS PACKAGING CONVENTION AND EXHIBITION—INTERNEPCON/EUROPA		
Location: Centre Rogier, Brussels		
Sponsor: Industrial and Scientific Conference Management, Inc. 22 West Adams Street, Chicago, Illinois 60606	June	June
Frequency: Annual		

EVENT	1975	1976
INTERELECTRONIC		
Location: Palais Du Centenaire, Brussels		
Sponsor: Union Professionnelle des Fabricants et Importateurs de Materiel Electronique, 74 Avenue Moliere, 1180, Brussels		November
Frequency: Biennial		
FRANCE		
MICROWAVE TECHNOLOGY EXHIBITION		
Location: U.S. Trade Center, 123 Avenue Charles De Gaulle, 92 Neuilly, Paris		
Sponsor: U.S. Department of Commerce, Bureau of International Commerce, Washington, D.C. 20230	February	
Frequency: (Proposed)		
INTERNATIONAL ELECTRONIC COMPONENTS EXHIBITION		
Location: Parc des Expositions, Port de Versailles, Paris		
Sponsor: Societe Pour La Diffusion des Sciences et des Arts, 14 Rue de Presles, 75740 Paris	April	April
Frequency: Annual		
ELECTRONIC COMPONENTS EXHIBITION		
Location: U.S. Trade Center, 123 Avenue Charles De Gaulle, 92 Neuilly, Paris		
Sponsor: U.S. Department of Commerce, Bureau of International Commerce, Washington, D.C. 20230	June	
Frequency: (Proposed)		
GERMANY		
HANNOVER SPRING FAIR		
Location: Messegelaende, Hanover	April-	April-
Sponsor: Messe—U. Ausstellungen A.G., 3 Hannover, Messegelaende	May	May
Frequency: Annual		
ELECTRONICA—INTERNATIONAL ELECTRONIC COMPONENTS EXHIBITION		
Location: Messegelaende, Theresienhoehe, Munich		
Sponsor: Internationaler Elektronik Arbeitskreis E.V., 8 Muenchen, Theresienhoehe 15		November
Frequency: Biennial		
MICROELECTRONIC CONGRESS		
Location: Messegelaende, Theresienhoehe, Munich		
Sponsor: Internationaler Elektronik Arbeitskreis E.V., 8 Muenchen, Theresienhoehe 15		November
Frequency: Biennial		
INDIA		
ALL INDIA ELECTRONICS CONFERENCE		
Location: Vigyan Bhawan, New Delhi		February-
Sponsor: Department of Electronics, Government of India, Vigyan Bhawan Annexe, New Delhi 110001		March
Frequency: (Proposed)		

EVENT	1975	1976
ISRAEL		
NINTH CONVENTION OF ELECTRICAL AND ELECTRONICS ENGINEERS (WITH EXHIBITION AND SYMPOSIUM)		
Location: Exhibition Gardens, Tel Aviv		
Sponsor: Institute of Electrical and Electronics Engineers (Israeli Chapter), P.O. Box 29234, Tel Aviv	April	
Frequency: Biennial		
TECHNOLOGY 75 (INTERNATIONAL TRADE FAIR)		
Location: Exhibition Gardens, Tel Aviv		
Sponsor: Ministry of Commerce/Tel Aviv Municipality	June	
Frequency: Biennial		
ELECTRONIC WEEK		
Location: Jerusalem		
Sponsor: Jerusalem Economic Conference and Ministry of Commerce Industry, Jerusalem		January
Frequency: (Proposed)		
ITALY		
ADVANCED ELECTRONIC COMPONENTS EXHIBITION		
Location: U.S. Trade Center, Via Gattamelata 5, 20149, Milan		
Sponsor: U.S. Department of Commerce, Bureau of International Commerce, Washington, D.C. 20230	February	
Frequency: (Proposed)		
INTERNATIONAL EXHIBITION OF COMPONENTS, ELECTRONIC MEASURING INSTRUMENTS AND ACCESSORIES		
Location: Milan Fair Grounds, Milan		May-
Sponsor: ANIE—Associazione Nazionale Industrie Electrotechniche, Gruppo 29, "Componenti Electronici," Via Luciano Manara 1, 20122 Milan		June
Frequency: (Proposed; dates are tentative)		
ELECTRONIC COMPONENTS TECHNICAL MEETING		
Location: Milan Fairgrounds, Milan (Held in Conjunction with the Electronic Components Technical Meeting)		
Sponsor: ANIE—Associazione Nazionale Industries Electrotechniche Gruppo 29 "Componenti Elettronici," Via Luchiani Manara 1, 20122 Milan		May- June
Frequency: (Proposed; dates are tentative)		
JAPAN		
INTERNEPCON/JAPAN		
Location: Tokyo International Trade Fair Grounds, Tokyo		
Sponsor: Industrial and Scientific Management, Inc., (Japan Branch), P.O. Box 5355, Tokyo International Post Office	January	January
Frequency: Annual		

EVENT	1975	1976
JAPAN ELECTRONICS SHOW: OSAKA INTERNATIONAL TRADE FAIR		
Location: Minato Fairgrounds, Osaka		
Sponsor: Electronic Industries Assoc., Shokolaigisho Bldg., 3-2-2, Marunochi, Chiyoda-Ku, Tokyo	September	September
Frequency: Annual		
JAPAN PRINTED CIRCUIT ASSOCIATION SHOW		
Location: Tokyo International Trade Fair Grounds, Tokyo		
Sponsor: Japan Printed Circuit Assoc., Yoshida Bldg., 21, Shiba Kamiya-Cho, Minato-Ku, Tokyo	November	November
Frequency: Annual		
TENTH EXHIBITION OF NEW ELECTRICAL INSULATING MATERIALS		
Location: Tokyo Industrial Center, Ohtemachi Hall, Tokyo		
Sponsor: Japan Electrical Insulating Materials Industry Assoc., IwAO Bldg., 21, Sakuragawa, Shiba-Nishikubo, Minato-Ku, Tokyo	November	November
Frequency: Annual		
ELECTRONIC PARTS EXHIBITION		
Location: Tokyo Industrial Center, Ohtemachi Hall, Tokyo		
Sponsor: The Industrial Daily News, 1-8-10, Kudan-Kita, Chiyoda-Ku, Tokyo	November	November
Frequency: Annual		
KOREA		
KOREA ELECTRONICS SHOW		
Location: Kyongbok Palace, Seoul		
Sponsor: Korea Fine Instruments Center, I.P.O. Box 2489, Seoul 222-13, Kooro-Dong, Youngdeungpo-Ku, Seoul	September- October	September- October
Frequency: Annual		
KOREA ELECTRONICS ENGINEERING SEMINAR		
Location: Kyongbok Palace, Seoul (In conjunction with the Korea Electronics Show)		
Sponsor: Korea Fine Instruments Center, I.P.O. Box 2489, Seoul 222-13, Kooro-Dong, YoungDeungpo-Ku, Seoul	September- October	September- October
Frequency: Annual		
MEXICO		
ELECTRO-OPTICS AND LASERS		
Location: U.S. Trade Center, Mexico City		
Sponsor: U.S. Dept. of Commerce (Joint Export Establishment Promotion)	May	
Frequency: (Tentative)		
NEPCON INTER AMERICAS		
Location: Hotel Camino Real, Mexico City		
Sponsor: Industrial and Scientific Management, 222 W. Adams, Chicago, Ill.	November	November
Frequency: Annual		

EVENT	1975	1976
NETHERLANDS		
HET INSTRUMENT		
Location: RAI Exhibition Hall, Europaplein 8, Amsterdam		
Sponsor: HET Instrument, Birkstraat 108, P.O. Box 152, Soest	September	
Frequency: Biennial		
INTERNATIONAL EXHIBITION OF ENTERTAINMENT ELECTRONICS —FIRATO		
Location: RAI Exhibition Hall, Amsterdam		
Sponsor: Stichting Firato Radio Tentoonstelling Johan van der Waalsstraat 8, Amsterdam		August- September
Frequency: Biennial		
INTERNATIONAL INDUSTRIAL ELECTRONICS TRADE FAIR— FIAREX		
Location: RAI Exhibition Hall, Europaplein 8, Amsterdam		
Sponsor: Stichting Firato Radio Tentoonstelling Johan van der Waalsstraat 8, Amsterdam		October- November
Frequency: Biennial		
ROMANIA		
TIBCO—CONSUMER GOODS FAIR		
Location: Piata Scintei No. 1, Bucharest		
Sponsor: Chamber of Commerce of the Socialist Republic of Romania, International Fair Board, Piata Scintei No. 1, Bucharest	May	
Frequency: Biennial		
SPECIALIZED EXHIBITION OF ELECTRONIC MEASURING AND CONTROL INSTRUMENTS FOR INDUSTRIAL AND SCIENTIFIC USE		
Location: Exhibition Pavilion, Bucharest		
Sponsor: Publicom, Boul. Balcescu 22, Bucharest	November	
Frequency: Biennial		
BUCHAREST INTERNATIONAL FAIR		
Location: Exhibition Pavilion, Bucharest		
Sponsor: Chamber of Commerce of the Romanian Socialist Republic		October
Frequency: Biennial		
SPAIN		
TECHNICAL FAIR OF ELECTRICAL MACHINERY AND MATERIALS HANDLING EQUIPMENT (WITH "AUTOMATION" SECTION)		
Location: Fairgrounds, Bilbao		
Sponsor: Feria Internacional de Muestras de Bilbao, Tercio de Begona 2, Bilbao	March	
Frequency: Biennial (Foreign participation permitted in "Automation" Section only.)		

EVENT	1975	1976
SONIMAG—IMAGE, SOUND AND ELECTRONIC SHOW		
Location: Parque de Montjuich, Barcelona		
Sponsor: Comision Delegada de Sonimag, Avenida Maria Cristina, Palacio No. 1, Barcelona—4	October-November	October-November
Frequency: Annual (Foreign participation permitted through local agent only.)		
SWEDEN		
IM75-TENTH INTERNATIONAL TRADE FAIR FOR INSTRUMENTS AND MEASUREMENTS		
Location: Swedish International Fair and Activities Center (ALVSJO), Stockholm		
Sponsor: The Swedish Society of Instrumentation Suppliers and AB St. Eriks Massan, S-106 80 Stockholm	April	
Frequency: Triennial		
STOCKHOLM TECHNICAL FAIR		
Location: Swedish International Fair and Activities Center (ALVSJO), Stockholm		
Sponsor: AB St. Eriks Massan, S-106 80 Stockholm	October	October
Frequency: Annual		
ELFACK 75 INTERNATIONAL ELECTRO-TECHNICAL FAIR		
Location: Svenska Massan, Gothenburg		
Sponsor: Svenska Massan Stiftelse/The Swedish Trade Fair Foundation, S-412 51 Goteborg	October	
Frequency: Biennial		
SWITZERLAND		
INEL-75 SEVENTH INTERNATIONAL INDUSTRIAL ELECTRONICS EXHIBITION		
Location: Swiss Industries Fair, Basel		
Sponsor: Swiss Industries Fair, P.O. Box 4021, Basel	September	
Frequency: Biennial		
SAMA INTERNATIONAL FAIR FOR ASSEMBLING, MINIATURIZATION AND AUTOMATION		
Location: Allmend Exhibition Centre, Berne		
Sponsor: SAMA International SA, P.O. Box 1052-CH2501, Bienne	September	September
Frequency: Annual		
TAIWAN		
REPUBLIC OF CHINA ELECTRONICS EXHIBITION		
Location: Taipei		
Sponsor: Taiwan Electrical Appliance Manufacturers Association (TEAMA), 9 Changan East Road, Section 1, Taipei	October-November	
Frequency: Annual		

EVENT	1975	1976
UNITED KINGDOM		
LONDON ELECTRONIC COMPONENTS EXHIBITION		
Location: London		
Sponsor: Industrial Exhibitions Ltd., Commonwealth House, 1-10 New Oxford St., London WCIA IPB	May	
Frequency: Biennial		
INTERNATIONAL MICROWAVE CONFERENCE AND EXHIBITION		
Location: Metropole Exhibition Hall, Brighton, Sussex		
Sponsor: P. Gordon Saville, Exhibitions Director, 21 Victoria Road, Surbiton, Surrey	June	
Frequency: Biennial		
TELECOMMUNICATIONS CONFERENCE AND EXHIBITION		
Location: Metropole Exhibition Hall, Brighton		
Sponsor: P. Gordon Saville, Exhibition Director, 21 Victoria Road, Surbiton, Surrey	June	
IEA-INTERNATIONAL INSTRUMENTS, ELECTRONICS AND AUTOMATION EXHIBITION		
Location: Olympia		
Sponsor: Industrial Trade Fairs Ltd., Commonwealth House, New Oxford St., London WCIA IPB		May
Frequency: Biennial		





PENN STATE UNIVERSITY LIBRARIES



A000070952254

